November

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Science and Invention

IN PICTURES

SCIENTIST MAKES GOLD

See Page 654

40 NON-TECHNICAL RADIO ARTICLES

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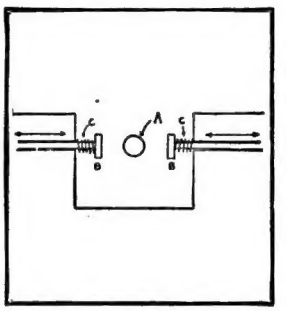
New Book About "What and How To Invent"

Invention is the easiest way to earn a fortune. Little ideas have made millions of dollars for their inventors. A wonderful book, recently written, explains how fifteen famous inventors now teach you in your own home the secrets of successful invention known and used by every great inventor; what to invent and how to invent, what dangers to avoid, the methods that make it easier to complete inventions, hundreds of other valuable facts not obtainable elsewhere—and *why you already possess the native ability to become an inventor.*

This test shows how easily you can develop your ability to invent.



Here is an interesting little problem and its solution will be found very simple, if we really think hard.

"A" is the end of a shaft. The two members "B B" are free to move in either direction indicated by the arrows. If they are pushed back, the springs "C C" will immediately pull them forward again. Our problem is to put some kind of an attachment on the revolving shaft "A" so that the members "B B" will be pushed back both at the same instant every time the shaft "A" makes a single revolution. The device on shaft "A" must also allow the two members "B B" to come forward once in every revolution. What would you suggest putting on the shaft "A"?

This simple problem proves YOU CAN INVENT

THOUSANDS upon thousands of persons have inventive ability and do not know it, or do not develop it. Invention is open to everybody. From a farmer's 17-year-old son to the King of England—men and women of every age, class and degree of education have produced valuable money-making inventions. Your chances are as good as anybody's—because ANYBODY WHO CAN THINK CAN LEARN TO INVENT!

It is easy to prove that this statement is true. What were our greatest inventors before they invented anything? Simon Lake was a schoolboy. Bell was a teacher. Edison was a telegrapher. Gilette was a traveling salesman. Others were office clerks, mechanics, farmers, peddlers, housewives. Yet they all became inventors!

Little Ideas Worth Fortunes

One reason why most people think that they cannot invent is that they think of an invention as something like the steam-engine, the automobile, the aeroplane, the submarine. Few people think of the ice-pick, can-opener, glove-clasp paper safety match, metal-tip shoe string and wire paper clip as inventions. Yet every one of these little inventions have enabled their inventors to reap large fortunes, to live in ease, to enjoy the comforts and pleasures of life.

Surely you have often had ideas for inventions just like these. It may be a new toy for your children. The man who invented the Kiddie-Kar, it is reported, made over $5,000,000. It may be a new kind of soap. B. T. Babbitt is worth millions of dollars today. Even so simple a thing as a common wooden wedge to stop the wabbling of tables and chairs (which millions of people must have thought of has brought the woman, who DID something with her idea, a respectable fortune!

Proof Invention Can Be Taught

Invention is not guesswork or blind luck—it is not a God-given faculty possessed by a few favorite mortals. As a matter of fact inventors themselves say that invention is based upon exact laws of thought and action which anyone can learn. Even Edison says: **"Invention is a science and should be taught as a profession."**

Prove to your own satisfaction, that you can learn how to invent. At the top right hand corner of this page is a simple problem in invention. See how quickly you can find its solution. A little thought will give you the answer in a few minutes.

When you have gotten your answer you will have found the fundamental idea behind the ordinary electric light switch—an idea which has earned its inventor thousands of dollars! This simple test, besides proving that you can learn to invent, also proves that you have the ability to develop ideas for any invention—because every invention was produced in exactly the same way.

Raymond F. Yates, who with fourteen other famous inventors, now makes it easy to learn how to invent in your spare time at home.

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—How to develop your ideas.
—How to get the facts you need for inventions.
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—How to organize a company.
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—How to market a patent.

and hundreds of other vitally important facts which EVERY successful inventor knows and uses.

Now Fifteen Famous Inventors Teach You How to Invent

Now for the first time you can profit by Edison's advice. You can actually learn invention as a profession—exactly as other people are learning electricity, mechanics, law, medicine.

Fifteen famous inventors tell you WHAT TO INVENT and HOW TO INVENT. They tell you the secrets of inventions which every successful inventor knows. They explain how to originate ideas, how to develop and perfect them, how to get patents. But they tell you even more. Thousands of inexperienced inventors have been defrauded of their rewards because they did not know how to protect their patent rights. This great course tells you everything you want to know—how to sell your invention, how to get royalties—how to get the most money for your ideas.

The Bureau of Inventive Science offers you the first course in practical invention ever devised. It has written down the easy-to-learn principles of Inventive Science so that everybody can read them and learn to use them. It doesn't matter who you are, or what your present work is—you have the native ability to invent—which you proved you now have by solving the problem shown on this page. What you need now is to develop this ability so you can use it to produce practical inventions. All you need, to become successful, is this easy, fascinating training which will develop your ability so it will be worth real money.

New FREE Book

The most interesting part of this wonderful course is that it teaches invention by actual practice right in your own home. With each lesson you are sent at least one practical problem in invention just like the one you solved here. This absorbing exercise in solving actual inventive problems sharpens your instinct to fix things. Better than anything else it gives you an unforgetable, instinctive habit of thinking inventively, which is worth more than you realize. In fact, the lessons and exercises are so simple, so easy to understand, so interesting, that they seem more like a pleasant game than like instruction which can make you a successful inventor.

A wonderful new book, just printed, tells you more about the Bureau of Inventive Science and its simple new course in invention. It costs nothing, so send the coupon at once. This bureau is not connected with patent attorneys or manufacturers. Its only purpose is to teach you the principles of practical invention used by every successful inventor. Write for the FREE BOOK now. It may show you the way to make a fortune!

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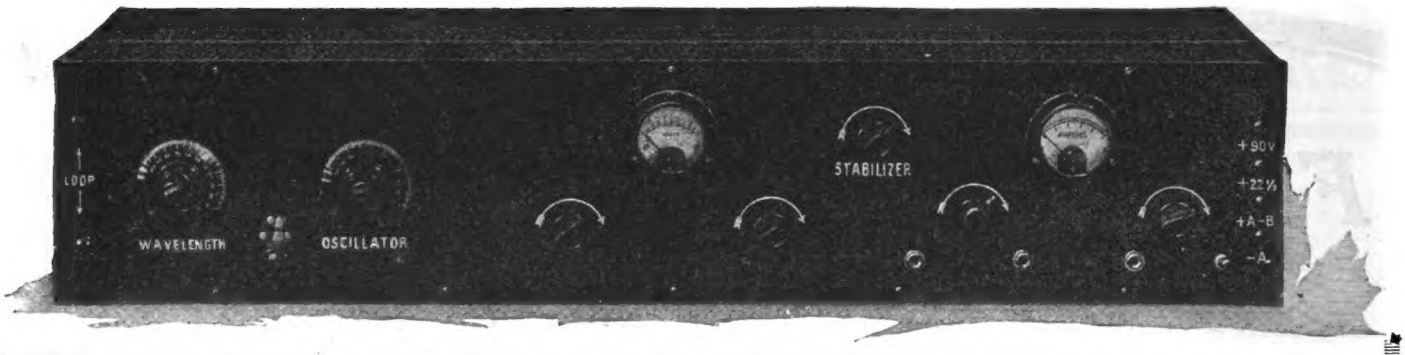

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30 Days Ago They *Laughed at Me*

I never would have believed that anyone could become popular overnight. And yet—here's what happened.

ONE evening, about a month ago, I went to a dance. Just a jolly, informal sort of dance where everyone knew almost everyone else. I wouldn't have gone to a really big or important dance, because I—well, I wasn't sure of myself.

There was a young woman at this dance I had long wanted to meet. Someone introduced us, and before I knew it I was dancing with her. That is, I was *trying* to dance with her. She was an exquisite dancer, graceful, poised, at ease. Her steps were in perfect harmony with the music.

But I, clumsy boor that I was, found myself following her instead of leading. And I couldn't follow! That was the sad part of it. I stumbled through the steps. I trod on her toes. I tried desperately to keep in time with the music. You cannot imagine how uncomfortable I was, how conspicuous I felt.

Suddenly I realized that we were practically the only couple on the floor. The boys had gathered in a little group and were laughing. I knew, in an instant, that they were laughing at me. I glanced at my partner, and saw that she, too, was smiling. She had entered into the fun. Fun! At my expense!

I felt myself blushing furiously, and I hated myself for it. Very well. Let them laugh. Someday I would show them. Someday I would laugh at them as they had laughed at me.

All the way home I told myself over and over again that I would become a perfect dancer, that I would amaze and astonish them. But how? I couldn't go to a dancing school because of the time and expense. I certainly couldn't afford a dancing instructor. What could I do?

By morning I had forgotten my anger and humiliation and with them the desire to become a perfect dancer. But three weeks later I received another invitation. It was from Jack. He wanted me to come to a small dance at his home, a dance to which, I knew, the same people would come. I wouldn't go, of couse. I wouldn't give them the chance to laugh at me again. But that night Jack called. "Coming to the dance?" he asked. "No!" I retorted.

He grinned, and I knew why. It infuriated me. A daring plan flashed through my mind. Yes, I *would* come. I would show them this time that they couldn't laugh at me.

"I've changed my mind," I said to Jack. "I'll be there." Jack grinned again—and was gone.

Popular Overnight!

I ran upstairs and found the magazine I had been reading the night before. One clip of the shears, a few words quickly written, a trip to the corner mail-box—and the first part of my plan was carried out. I had sent for Arthur Murray's free dancing lessons.

Somehow I didn't believe that dancing could be learned by mail. But there was nothing to risk—and think of the joy of being able to astound them all at the dance.

The free lessons arrived just the night before the dance. I was amazed at the ease with which I mastered a fascinating new fox-trot step. I learned how to lead, how to have ease and confidence while dancing, how to follow if my partner leads, how to dance in harmony with the music. It was fun to follow the simple diagrams and instructions. I gained a wonderful new ease and poise. I could hardly wait for Jack's dance.

The following evening I asked the best dancer in the room to dance with me. She hesitated a moment, then rose—smiling. I knew why she smiled. I knew why Jack and the other boys gathered in a little group. Good! Here was my chance.

It was a fox-trot. I led my partner gracefully around the room, interpreting the dance like a professional, keeping perfect harmony with the music. I say that she was astonished. I saw that we were the only couple on the floor and that everyone was watching us. I was at ease, thoroughly enjoying myself. When the music stopped there was applause!

It was a triumph. I could see how amazed everyone was. Jack and the boys actually envied me—and only 30 days ago they had laughed at me. No one will ever laugh at *my* dancing again. I became popular overnight!

You, too, can quickly learn dancing at home, without music and without a partner. More than 120,000 men and women have become accomplished dancers through Arthur Murray's remarkable new method.

Send today for the five free lessons. They will tell you more than anything we could possibly say. These five lessons which tell you the secret of leading, how to follow successfully, how to gain confidence, how to fox-trot and how to waltz—these complete five lessons are yours to keep, without obligation. Arthur Murray wants you to send for them at once, today—so that you can see for yourself how quickly and easily dancing can be mastered at home.

Clip and mail this coupon NOW. Please include 25c to cover the cost of handling, mailing, and printing. Arthur Murray, Studio, 296, 290 Broadway, New York.

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To prove that I can learn to dance at home in one evening, you may send me the FIVE FREE lessons by Arthur Murray. I enclose 25c to pay for the postage, printing, etc. This does not obligate me in any way.

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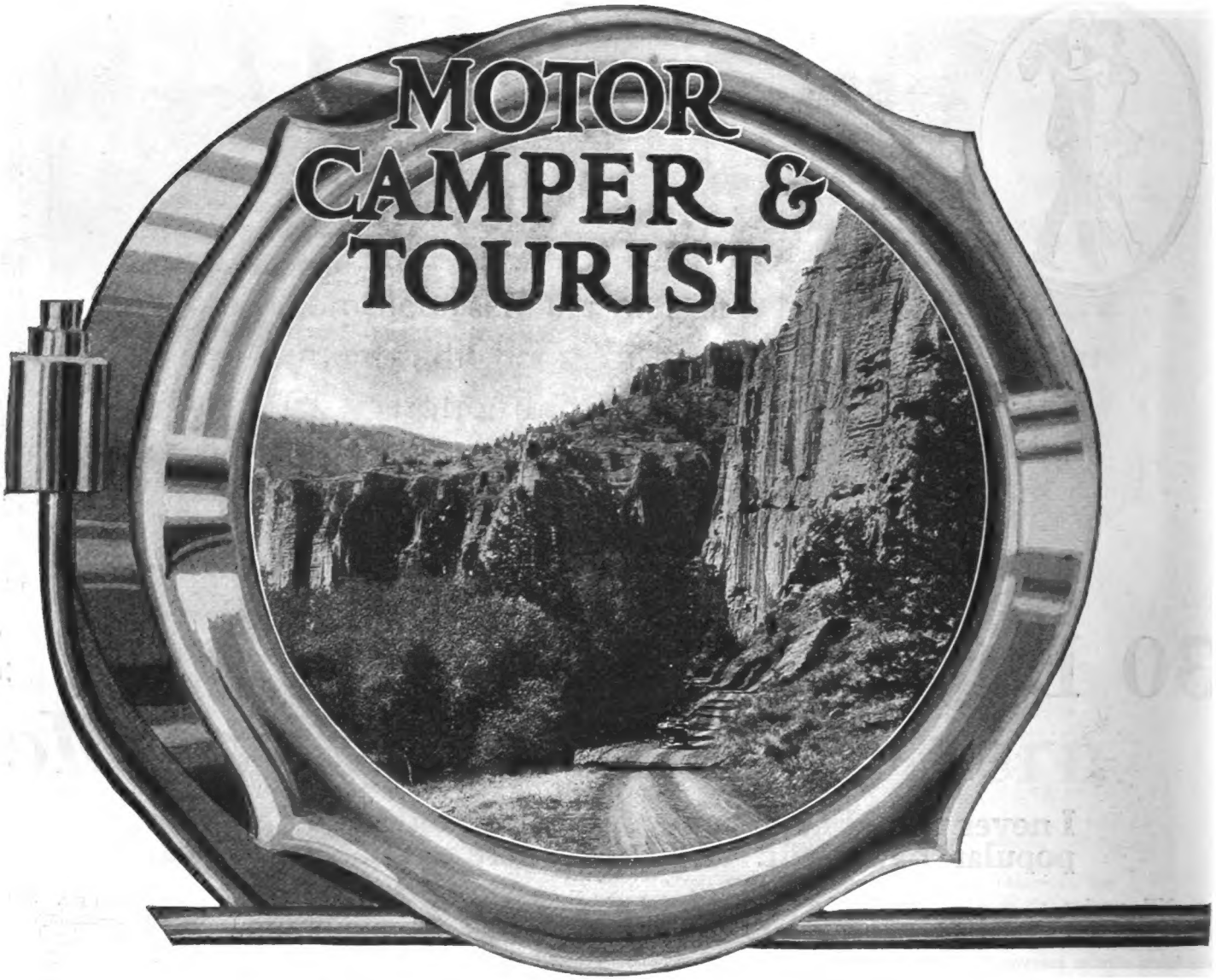

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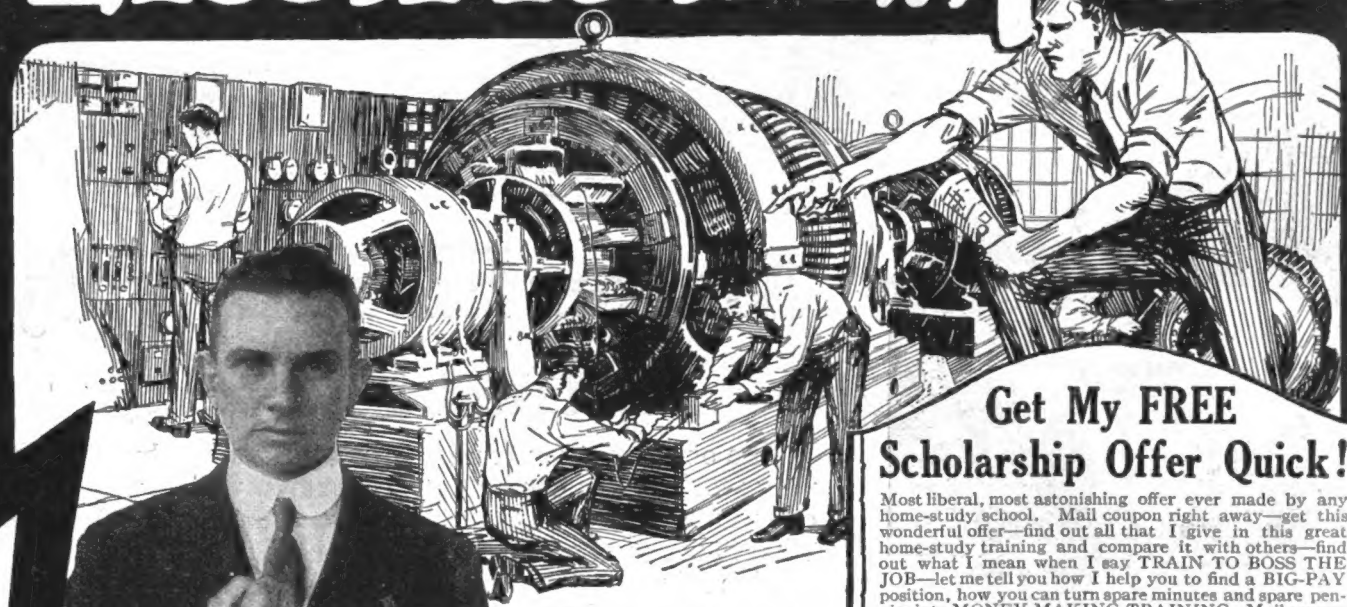

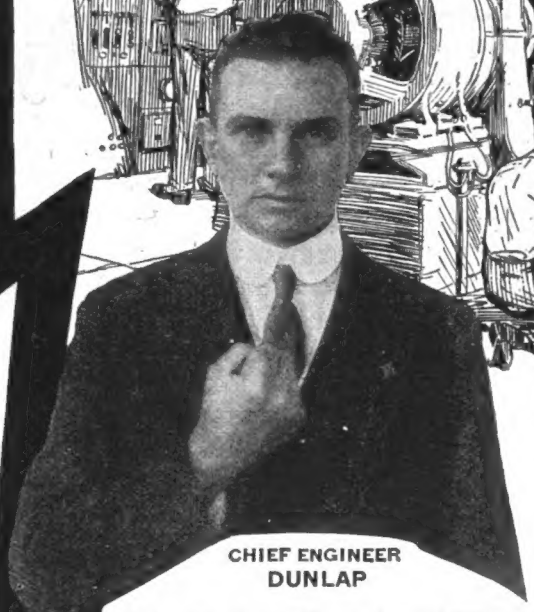

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22 of world's greatest Electrical Engineers helped me to prepare this training. AMERICAN SCHOOL said to me, "Dunlap, we want our Electrical instruction to prepare a man for the *big-pay executive positions*. We want to be able to truthfully say it is the biggest, MOST COMPLETE Electrical training on earth." Well, that meant neither I nor any other ONE man could prepare such a course in a dozen life-times, no ONE man could know everything about EVERY subject in Electricity. So I secured the help of 22 of America's greatest Electrical Engineers and executives of the following great corporations and Universities:

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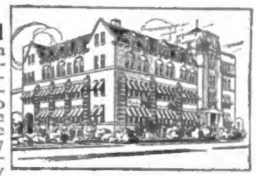

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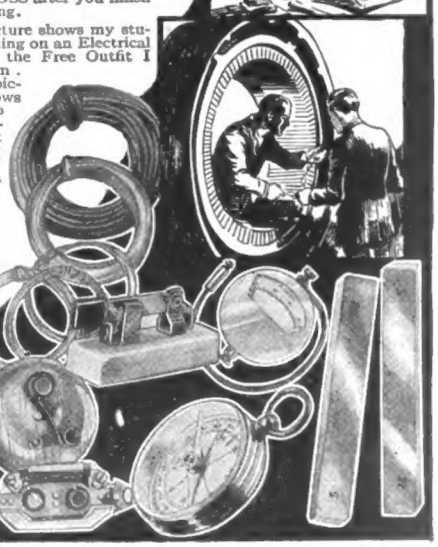
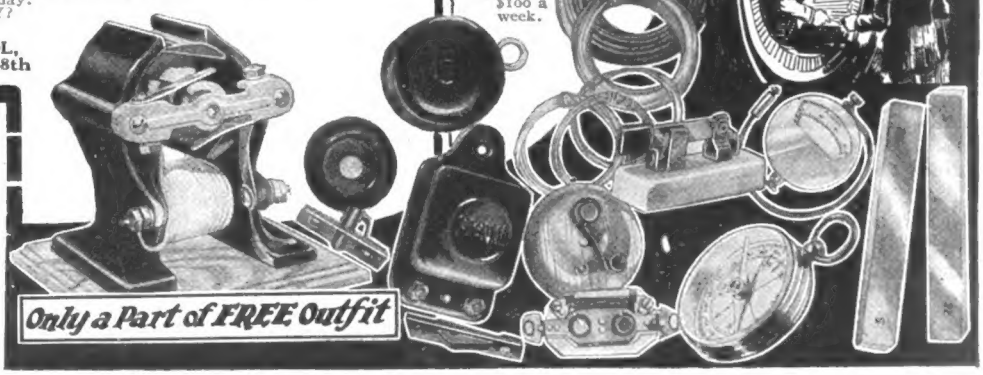
Upper picture shows my student working on an Electrical Job with the Free Outfit I send him. Lower picture shows similar job in big Power Plant good for salary of $100 a week.





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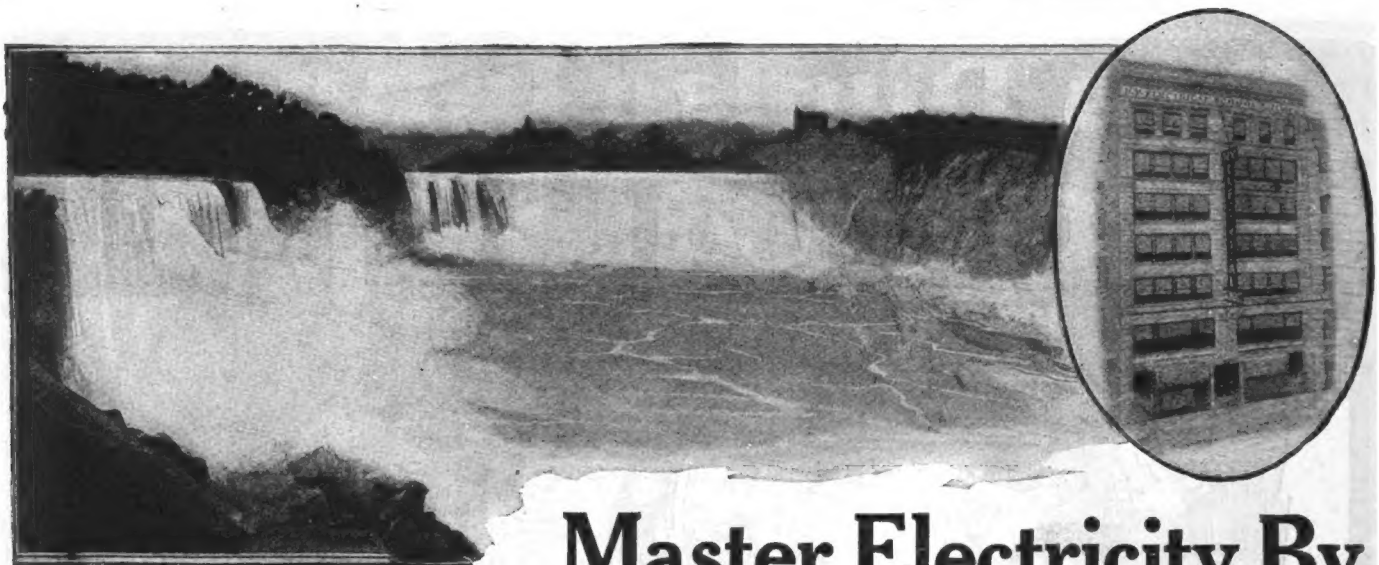

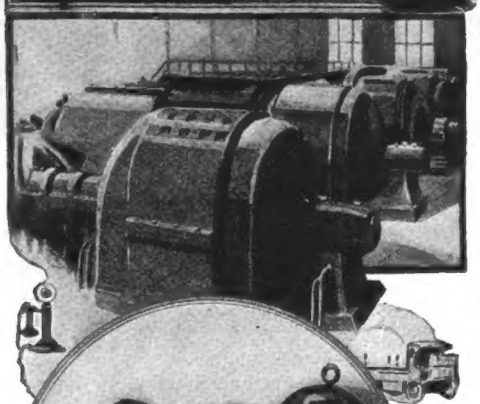

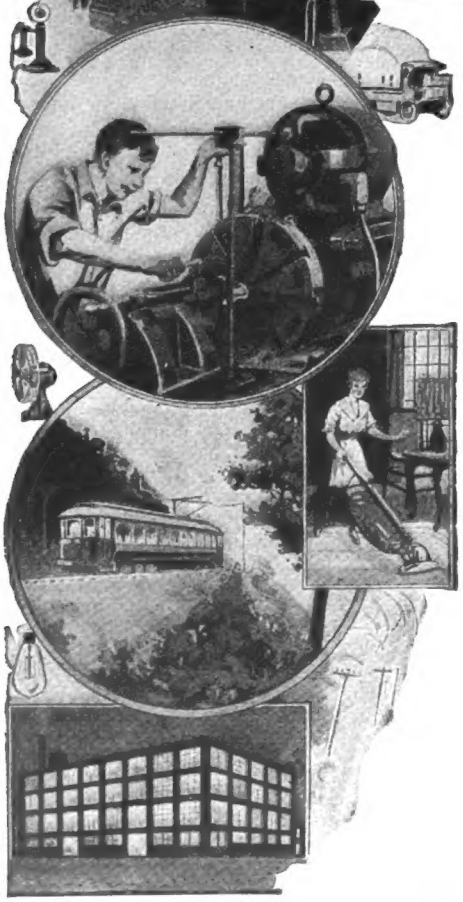

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Whole No. 139

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Nov. 1924
No. 7

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Editorial and General Offices, - - - 53 Park Place, New York

"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" - - - HUXLEY

Science and the Next War

By HUGO GERNSBACK

IT may be unpopular to speak of the next war, and indeed there are a good many souls who believe that we shall never have another war. These people in due time are in for a severe disappointment. War will always be on earth as long as human beings insist on rejecting arbitration, on having separate nationalities and on speaking different tongues. In the meantime, while this is being written, there are a number of small wars raging in different parts of the world — not big wars, to be sure, but wars just the same.

I BELIEVE
if war can be made too terrible—wars will cease.

In modern times, wars have been conducted chiefly by armies, while the civilian population stayed at home, where it was engaged either in civilian occupation or otherwise in helping the army at the front in various ways, such as providing ammunition, or indirectly supplying the myriad different things required by the fighting men. In the last war there came a change. No longer were the people at home allowed to work undisturbed in their pursuits to help win the war. By airplane the war was brought right into cities and towns removed hundreds of miles from the battle front. Whenever this happened it came as a tremendous shock to the civilian population and it brought home the lesson that modern war is no longer confined to the battle front. Indeed the next big war will be even more terrific and appalling than the one that ended in 1918. Airplanes and dirigibles will bring the war to your very doorstep. If bombs are not dropping all about you, the enemy will lay down a poison, or some noxious gas blanket right over the cities, in an endeavor to demoralize the civilian population.

I BELIEVE
that those who refuse to look into the future, are usually buried in the past.

As a matter of fact, the next war will be largely a chemical war. We have only begun to scratch the surface in chemical gas warfare. Every large country today has its chemical gas division in addition to other chemical warfare divisions. Indeed it is doubtful if great armies will ever face each other as they did in the World War. The battles will probably be fought largely by machines and in the air.

Very few people appreciate the fact that in television,—which problem has already been partially solved, —the War Lords will come into possession of a tremendous fighting weapon.

Already we have sent airplanes aloft without a human being on board. Such planes have been maneuvered easily at a distance. It is a simple matter today to bomb a distant city by means of a radio-controlled airplane. So far the necessary vision was missing, because if you sent a bombing plane beyond the vision of the operator on the ground, it will become almost impossible to drop bombs with any degree of accuracy. To be sure a control plane can trail the radio controlled plane and operate it in this manner from a distance, but even in this instance it is impossible to have the radio bombing plane place bombs with any degree of certainty.

I BELIEVE
today's greatest need is an international language, such as *Esperanto*.

Imagine now a radio-controlled plane with "electric eyes." These eyes would see to the front, to the left, straight ahead, backwards and up, as well as down; in six directions, in other words,—just the same, or perhaps better than is being done by the aviator.

Imagine also 50 or 100 miles away in a dug-out a radio-control board with its television apparatus. The operators in charge would have in front of them six screens, labeled North, South, East, West, Up, Down. The control operator would therefore be in position to see exactly what was going on around the plane, much better in fact than if he were sitting in and directing it. He could see the enemy plane above if it was trying to bomb his plane. The control operator, if he saw such an enemy plane coming into the field of his television screen, would immediately disengage a smoke screen from the radio-controlled plane in order to hide the movements of his plane. He could also drop his bombs anywhere he chose and these with extreme accuracy. The operator could recall his plane when the enemy got too strong or he could otherwise out-maneuver attacking planes.

Such radio television planes could be built for a moderate sum and it would require no long training of aviators to fly them. As everyone knows, it takes months to train an aviator and in war,—TIME is always the most precious thing.

If science succeeds in making wars too terrible, the nations will get together and fight it out around the arbitration table rather than under cities saturated with poisonous gases. It may take hundreds of years before this stage is reached, but it is coming nevertheless.

The radio-controlled television plane mentioned in this editorial is fully described with wash drawings and a comprehensive article by Hugo Gernsback in the November issue of

The Experimenter

on all newsstands October 20th.

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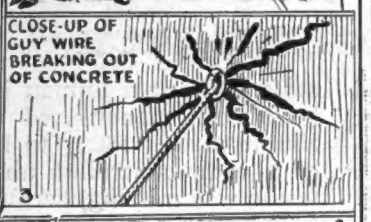
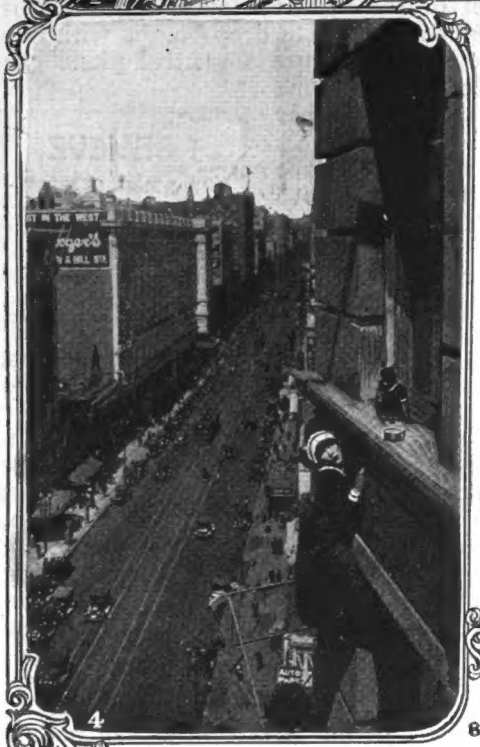
"Hold Your Breath"

By W. B.

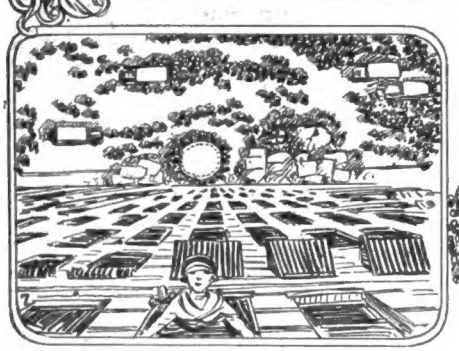
DOROTHY DEVORE, AS NEWSPAPER REPORTER, SECURES DIFFICULT INTERVIEW WITH CELEBRATED COLLECTOR OF CURIOS BY BREAKING INTO HIS HOTEL ROOM, DISGUISED AS BELL-HOP.
ORGAN-GRINDER'S MONKEY ESCAPES AND TAKES $50,000 BRACELET — SHE PURSUES HIM AND DETECTIVES PURSUE HER
1





HOTEL
SAVOY
SIGN STOPS HALF WAY UNTIL GUY WIRE BREAKS
SIGN FALLS AGAIN AND SHE STEPS OFF INTO WINDOW
6
SIGN IS LOWERED RATHER SLOWLY BY THIN STEEL WIRE: CAMERA RUNNING VERY SLOWLY GIVES APPEARANCE OF SIGN FALLING

PURE hokum it may be, but it is nevertheless screamingly funny, and will remain a monument to the mechanical director's ingenuity, this "Hold Your Breath" produced by Universal. Beginning at the top left of this page, and following clearly the story is completely told. The girl reporter (disguised with men's trousers) in an attempt to get a story climbs up the side of the hotel. An unusual stunt is employed to show the climbing; that is, a false set is erected atop a regular skyscraper and near enough to the edge so the camera takes in the street below as a background, as shown at 12 on the opposite page. Through this method with the aid of nets and mattresses, there is little danger to the players. As the girl climbs up the edge of the building, many humorous incidents attend her ascent. A Hebrew gentleman immediately gets an armful of chairs and rushes through the crowd which has gathered to watch the young lady, and does a thriving business at 25c per chair. The young lady's sweetheart meantime calls the fire department and rents a load of mattresses, piling them just below the point where the young lady is making her ascent. As she nears the top of the building a hobo monkey who


THIS FLASH IS THE ONLY PLACE WHERE SHE IS ACTUALLY PHOTOGRAPHED ON THE FRONT OF THE BUILDING. IT IS SHOT STRAIGHT DOWN FROM THE FLOOR ABOVE:— NOT HELD LONG ENOUGH FOR OBSERVER TO NOTICE THAT SHE STANDS SAFELY ON SILL

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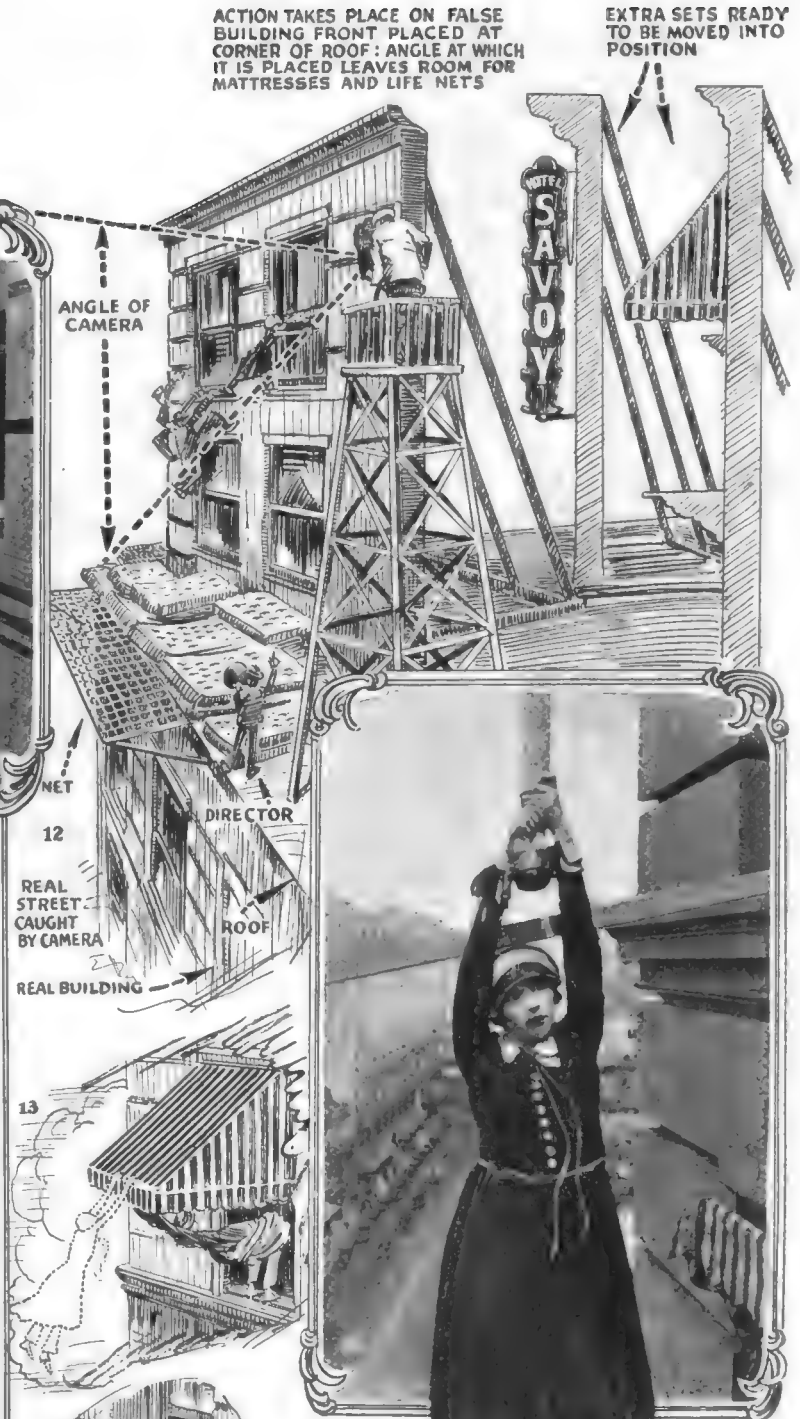
Gives Thrills

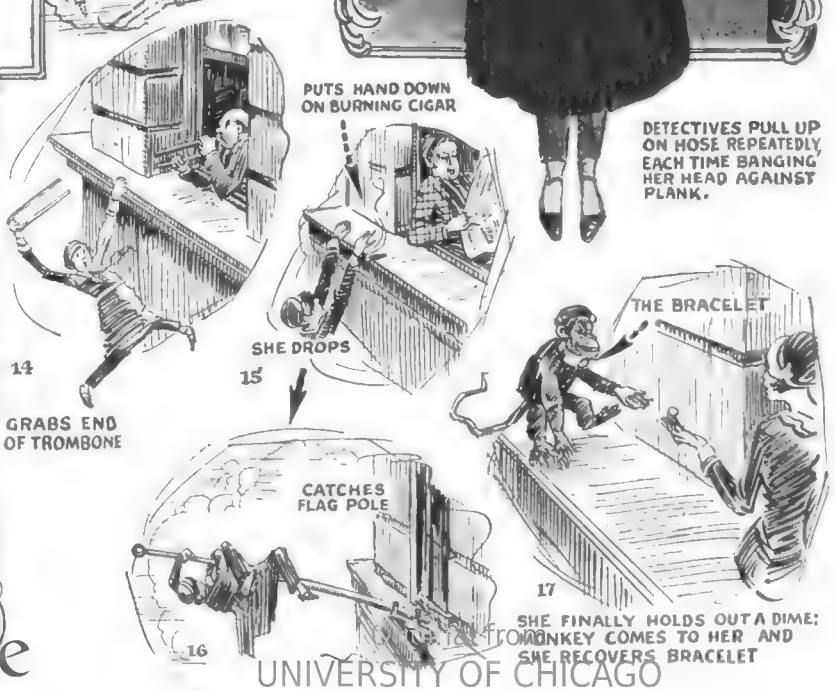
Arvin

stole the millionaire's bracelet and whom she is following, crawls on a sign. There is a close-up of the sign's support breaking. It immediately falls to a right-angle position, leaving the girl suspended in mid-air, and then down, allowing her to walk into a window of the building.

Then she is pulled up by the fire hose which hangs out of a window, but her progress is impeded by a board projecting out of a window in the course of her ascent, upon which she strikes her head repeatedly, as people above pull up the fire hose.

ONE of the most interesting incidents in the flight is precipitated when she places her hand on a burning cigar, as shown at 15. She then drops to a flag pole which breaks as she catches a hand hold on a ledge. She then catches at a trombone slide and falls into an awning. The awning breaks through and she is precipitated on to a second awning on the next floor below. This one rips and leaves her with many gyrations high and dry above the ground, but finally she again regains her footing and continues her climb up the face of the building.


ACTION TAKES PLACE ON FALSE BUILDING FRONT PLACED AT CORNER OF ROOF: ANGLE AT WHICH IT IS PLACED LEAVES ROOM FOR MATTRESSES AND LIFE NETS
EXTRA SETS READY TO BE MOVED INTO POSITION
ANGLE OF CAMERA
SAVOY
NET
12
DIRECTOR
REAL STREET CAUGHT BY CAMERA
ROOF
REAL BUILDING
13
DETECTIVES PULL UP ON HOSE REPEATEDLY, EACH TIME BANGING HER HEAD AGAINST PLANK.



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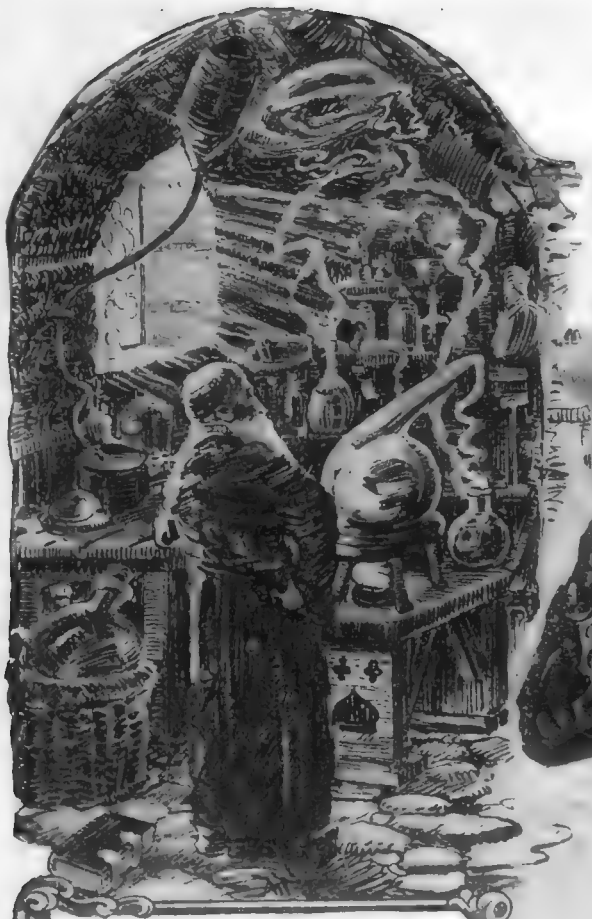
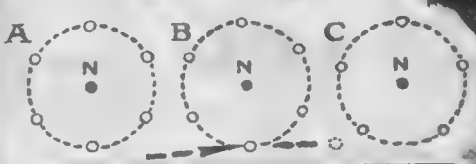
Gold from Mercury

By DR. ALFRED GRADENWITZ

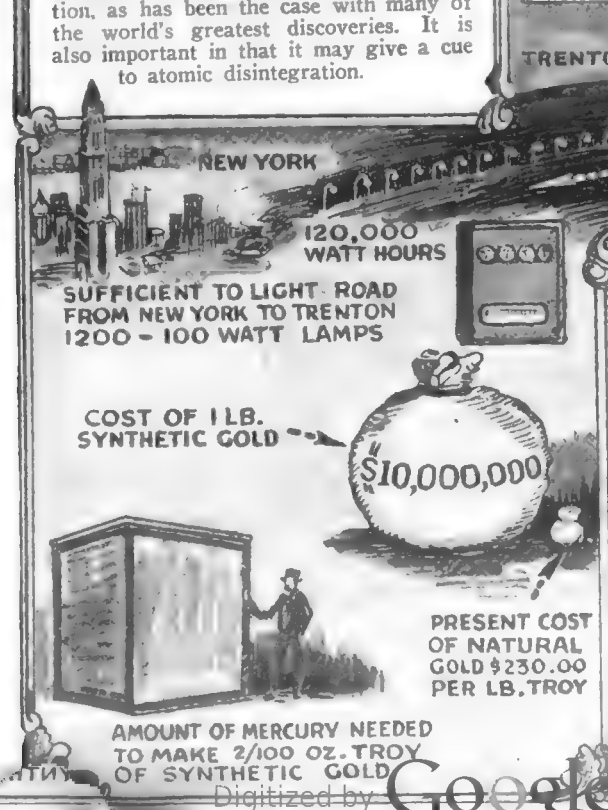
Special article from our German Correspondent



On the cover of this issue of SCIENCE AND INVENTION is given a picture of the modern alchemist changing mercury to gold. To the right and above is shown the huge mercury vapor lamp with pressure adjusting apparatus at the upper end, and the various electrical appliances used in the adjustment of this modern "Philosopher's Stone." The results of this experiment which has been so far-reaching in the field of experimental science, were due more to accident than to any well defined course of investigation, as has been the case with many of the world's greatest discoveries. It is also important in that it may give a cue to atomic disintegration.



Immediately above is shown graphically how the bombardment of the mercury atoms tears away one electron, thus forming gold. N is nucleus, A mercury, C gold, with electrons rearranged.



AT last the ancient alchemist's dream has come true, a baser metal has been turned into gold. Prof. Miethe, of Germany, while working with a large mercury vapor lamp, operating at a heavy overload, recently discovered particles in a deposit on the walls of the tube which could not be identified through usual theory or surmize. Later they proved to be gold. At first it was thought that the gold was merely a transferred deposit which originated as an impurity in the glass or in one of the electrodes within the lamp for the mercury. Later another lamp was constructed from chemically pure components and the original procedure followed with the new lamp. The deposit was again noted and identified. Upon consideration of the chemical laws involved, the theory was found to check accurately with practice. It was noted that the mercury atom contained one more electron than the gold atom. It was immediately postulated that through some peculiarity of the operation of the mercury vapor lamp the atoms of mercury were bombarded in such a way that one electron was torn from some of them, thus reducing the substance to gold. However, this discovery of the transmutation of mercury into gold will have no effect on the world's gold mines, since the cost of producing the metal artificially remains very much greater than that of the natural product as it is taken from the earth. The illustrations at the bottom of the page show graphically the extreme cost of gold at the present price of electricity.

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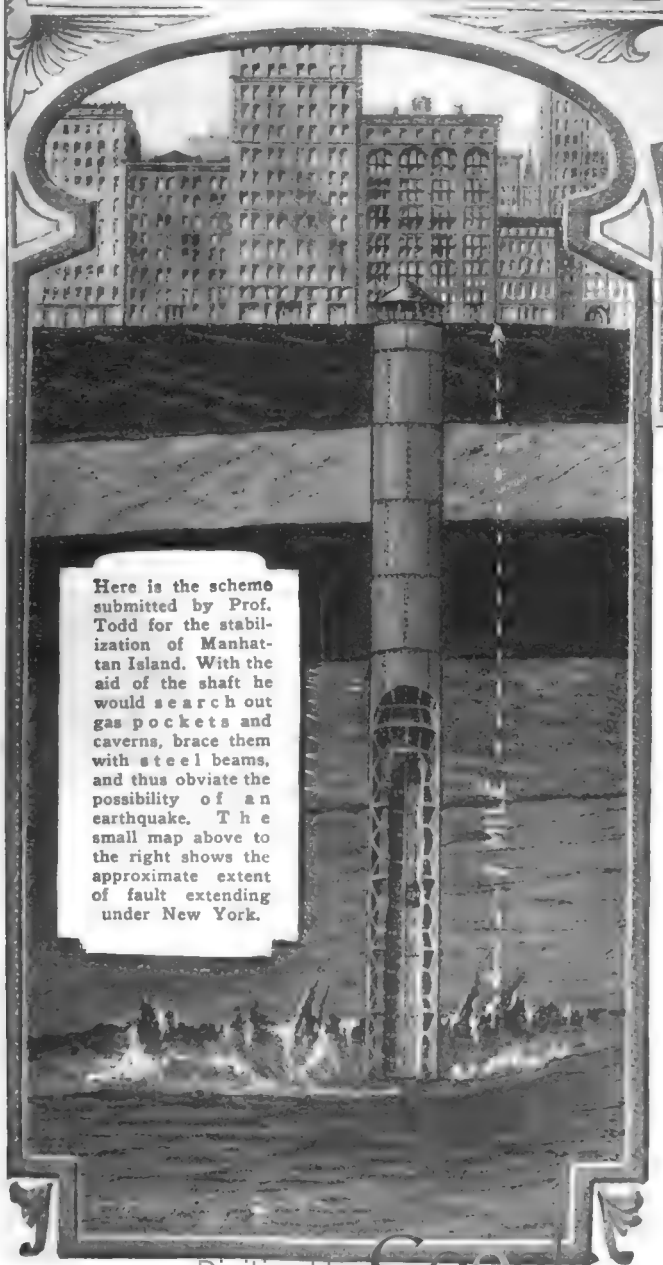
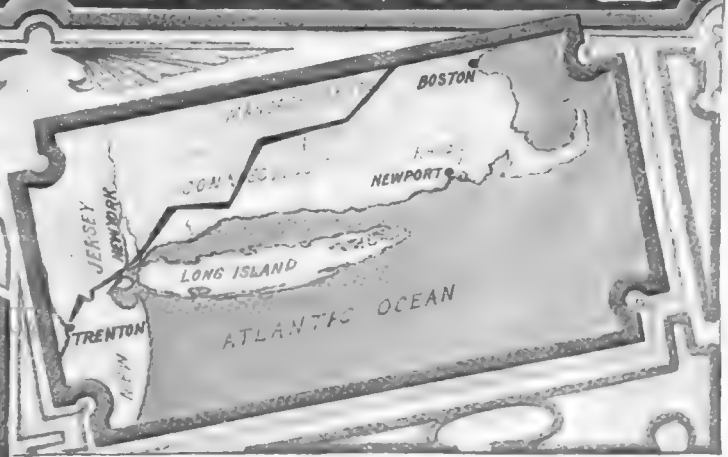
Above is shown a cross-section of the earth's crust beneath New York as it is conceived by Prof. Todd. The arrows show the dissipation of the stresses of thirty million tons per square mile placed on lower Manhattan Island.

Our artist here gives his conception based on Prof. Todd's assertions as to the crushing and crumbling which would take place in the earth's strata below New York in the event of an earthquake. Note the sidewise tumbling.



Here is the scheme submitted by Prof. Todd for the stabilization of Manhattan Island. With the aid of the shaft he would search out gas pockets and caverns, brace them with steel beams, and thus obviate the possibility of an earthquake. The small map above to the right shows the approximate extent of fault extending under New York.



Will New York Be Destroyed by Earthquake?

IN a recent statement given to the press Professor David Todd, astronomer and mathematician of Amherst College, said that, due to a fault running laterally from Trenton, N. J., across under Manhattan Island up through Connecticut and Massachusetts, and on account of possible gas pockets or caverns in the structure of the earth's crust, it was entirely possible for the extreme weight concentrated on the small area of Manhattan Island to force a shift in the rock formation, thus causing the island to give way in an earthquake. He likened the situation to placing one sheet of ice against another. Each sheet separately might hold a fair amount of weight, but if the weight were concentrated over the joint, the two sheets would immediately buckle. He suggested as a possible means of preventing such a disaster the drilling of a shaft a mile or so deep into the ground under Manhattan Island, in search of gas pockets or caverns, and if such were found, filling them with steel framework and concrete. However, Reverend Father Francis A. Tondorf, the world's foremost seismologist, in a special statement written for SCIENCE & INVENTION, states that there is no possibility of an earthquake of any dimensions in or near New York. He says it is well known that earth waves can only occur where there is a location of weakness and, although there is such a belt under the eastern part of the United States, it is sufficiently strong to withstand any pressure which man will be able to place upon it. "Although the skyscrapers," says Rev. Tondorf, "add materially to the weight, the final stress is communicated to a faultless, seamless structure directly under the island, and there is absolutely no scientific ground for the belief that any shift will be made in the crust underlying New York.

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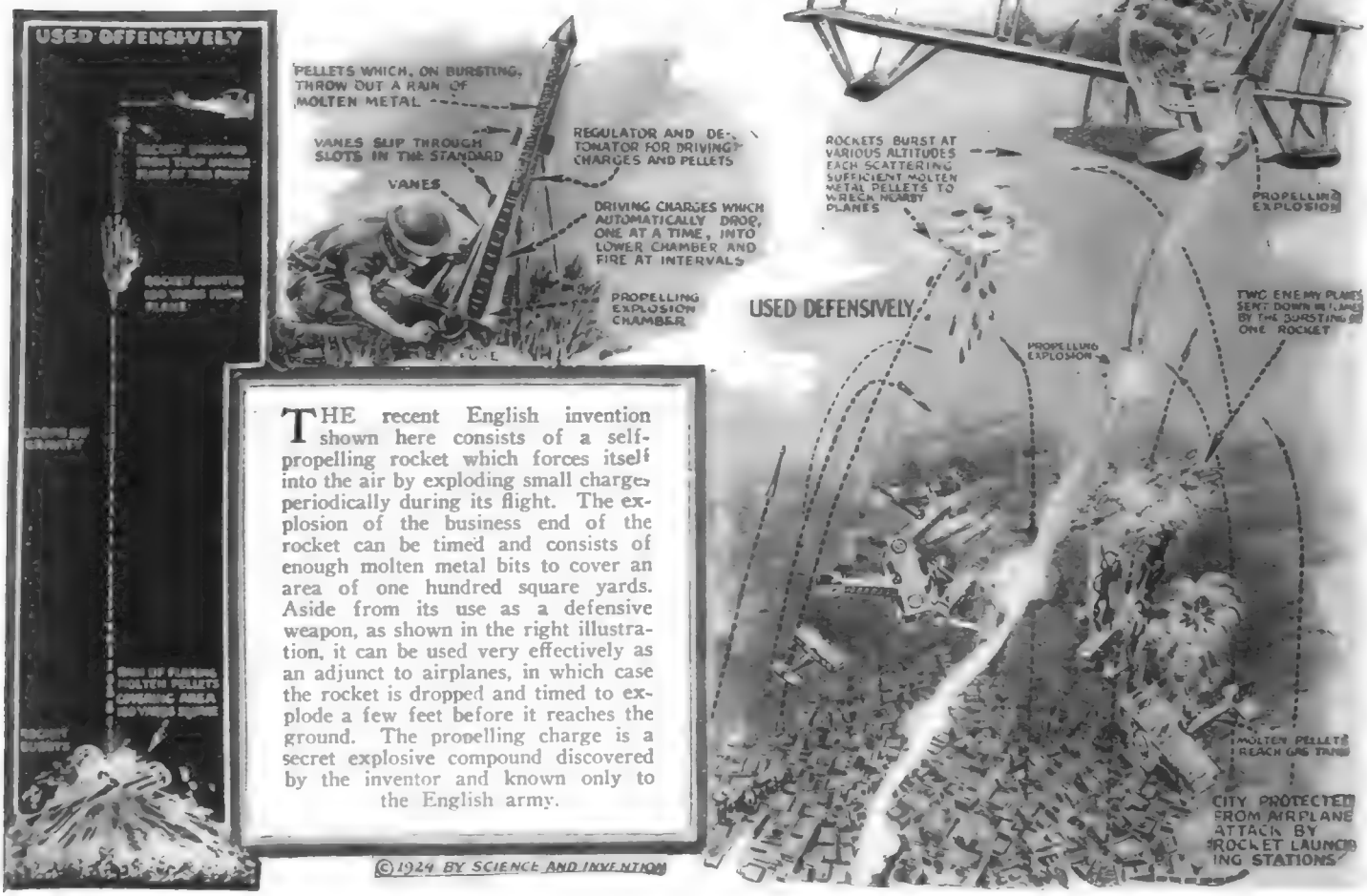
Death-Dealing Rocket


USED OFFENSIVELY
PELLETS WHICH, ON BURSTING, THROW OUT A RAIN OF MOLTEN METAL
VANES SLIP THROUGH SLOTS IN THE STANDARD
VANES
REGULATOR AND DETONATOR FOR DRIVING CHARGES AND PELLETS
DRIVING CHARGES WHICH AUTOMATICALLY DROP, ONE AT A TIME, INTO LOWER CHAMBER AND FIRE AT INTERVALS
PROPELLING EXPLOSION CHAMBER
ROCKET READY TO BURST AT TOP ALTITUDE—5 MILES
ROCKETS BURST AT VARIOUS ALTITUDES EACH SCATTERING SUFFICIENT MOLTEN METAL PELLETS TO WRECK NEARBY PLANES
PROPELLING EXPLOSION
USED DEFENSIVELY
TWO ENEMY PLANES SENT DOWN IN FLAMES BY THE BURSTING OF ONE ROCKET
PROPELLING EXPLOSION
MOLTEN PELLETS REACH GAS TANK
CITY PROTECTED FROM AIRPLANE ATTACK BY ROCKET LAUNCHING STATIONS

THE recent English invention shown here consists of a self-propelling rocket which forces itself into the air by exploding small charges periodically during its flight. The explosion of the business end of the rocket can be timed and consists of enough molten metal bits to cover an area of one hundred square yards. Aside from its use as a defensive weapon, as shown in the right illustration, it can be used very effectively as an adjunct to airplanes, in which case the rocket is dropped and timed to explode a few feet before it reaches the ground. The propelling charge is a secret explosive compound discovered by the inventor and known only to the English army.

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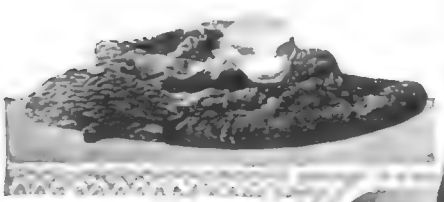
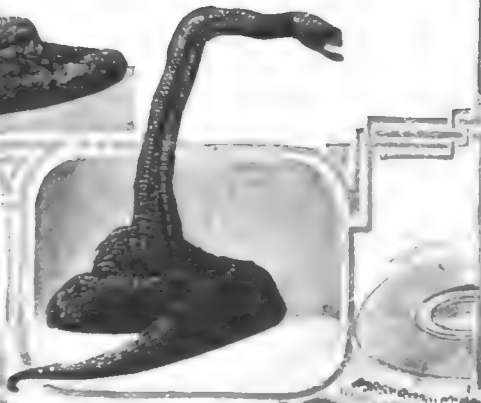
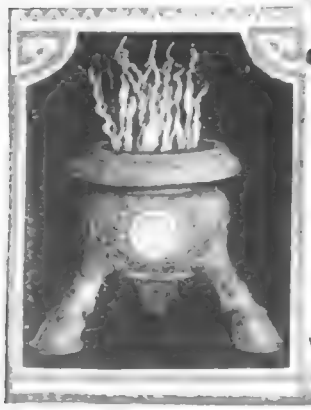
Some Weird Stage Effects

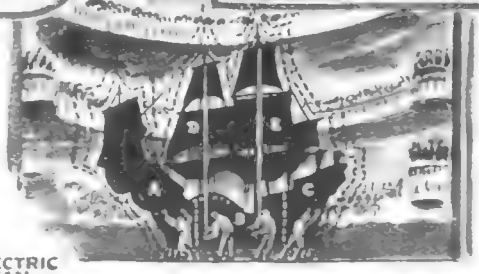


In a production in which a live serpent is used, the stage manager built a serpent of air-tight cloth and enlivened it at the proper moment by injecting compressed air into it.

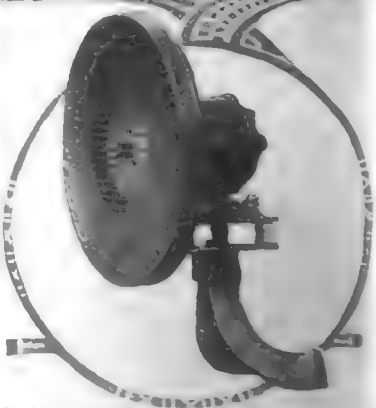




One of the most novel ways of producing stage fire is that shown above. Thin silk streamers are blown up flame fashion by a fan. Red lights furnish the glow.



By expanding a ship made in sections in three directions, the illusion of its sailing closer and closer can be easily accomplished. The stage hands separate the sections, making the ship seem constantly larger and larger. At right a machine producing the howl of the wind.



—Dr. A. Neuburger.

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Science Pictorial

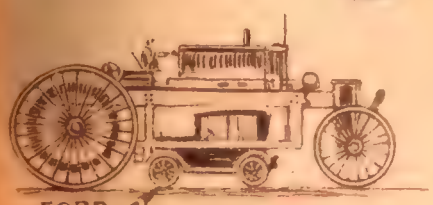
The Baltimore and Ohio Railroad has recently purchased several electric locomotives which run on rubber tires to be used in switching around large cities. The locomotive runs directly on the pavements obviating a great deal of work for the engineer. The current is furnished by a generator coupled to a gasoline engine contained in the locomotive. The engine can turn in its own length. —P and A Photos.

The latest craze in Italy is the Unicycle race. Above is a photograph of two of the machines used in this event. The riders sit on top of their motors on the inside of the large wheel, which is the chief component of the vehicle. —Fotograms, New York

Imagine the surprise of Colonel S. M. Saltmarsh of Los Angeles when he started to make a lemonade, cut his first lemon, and inside of it found a perfect miniature of a lemon tree. The plant was evidently growing and in good condition. The outside of the lemon was perfectly regular, there being no markings of any kind which might have given its secret away.

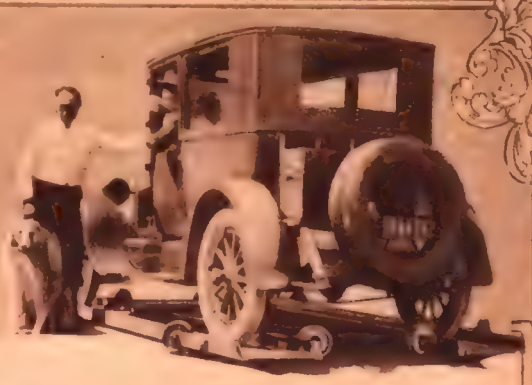
Twenty years ago P. A. Hummel, of St. Paul, Minn., invented a machine for transmitting pictures over wires. It was not tested until recently, when it was found to be a success. The machine employs a vibrating needle which passes over the surface of a traced picture, so that it marks the lines and blank spaces. The inventor is a jeweler.—Fotograms, New York.

Mr. A. Roberts claims that he was the originator of the death ray idea now claimed by H. Grindell-Matthews. Above he is shown stopping a motorcycle with his ray.



FORD

What is possibly the largest tractor ever built is the one shown below to the left, which was built for a Pacific Coast logging company. It is run by an internal combustion engine as is the ordinary tractor. It weighs ten tons and has a wheel base of eighteen feet. The wheels are 10 ft. in diameter.



On narrow streets the above shown turn table for automobiles will solve many traffic problems.

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Dr. Hackensaw's

By CLEMENT

No. 34. The Secret

"If you make the least noise, kid, I'll slash your throat as I did Doctor Hackensaw's!"

(Author's Note. Is "Perpetual Motion" possible? The encyclopedias and the physicists answer: "No!" They claim that a machine accomplishes work and hence uses up energy, and that since new energy must be supplied to replace the amount consumed, a perpetual motion machine is an impossibility. To the author, however, it seems rash to make any such assertion, until we know more about gravitation and molecular and atomic forces. Fifty years ago both encyclopedias and scientists declared the "Philosopher's Stone" an impossibility. But the discovery of radium changed matters entirely, and the transmutation of the metals may now be regarded as an assured fact.)

"DOCTOR," asked Pep Perkins, bouncing into the room where Doctor Hackensaw was examining with interest what appeared to be a child's "Ferris-wheel," "is Perpetual Motion possible?"

Doctor Hackensaw smiled. "Not only is 'Perpetual Motion' possible, Miss Pep," said he, "but no other kind of motion is possible. All motion is perpetual! As a matter of fact, the universe is based on two fundamental laws known as: First: The Law of the Conservation of Matter; and second: The Law of the Conservation of Energy."

"I don't understand."

"In simple words, all matter is perpetual and all motion is perpetual! Man cannot create or destroy a single particle of matter, nor can he create or destroy any energy. His power is limited to transforming one kind of matter or energy into another.

"Here for example is a book weighing one pound. No matter what I do to the book, I can make it weigh no more and no less than one pound. Suppose I cut the book into a thousand pieces, the pieces would still weigh a pound."

"Yes, but if you burned the book, it would weigh less!" cried Pep, delighted at having caught the doctor napping.

"Not a bit of it!" retorted the latter. "If I burned the book and carefully weighed the ashes and the gases and smoke that arose, I should find that they weighed much *more* than one pound; because, when the book burned, its carbon would have combined with some of the oxygen of the air to form 'carbon dioxide.' Deducting the oxygen thus added, I would find that the ashes and the product together would weigh exactly one pound. Not the smallest fraction of an ounce would be destroyed. This universal law is what is known as the Law of Conservation of Matter. *Not a particle of matter can be either created or destroyed!*"

"It doesn't seem possible," objected Pep; but Doctor Hackensaw quietly continued:

MOTION TOO

"Similarly with motion. If I slam my fist down on the table, the motion is not stopped. It is merely transformed into sound and heat, and wind and heat are merely motions of another kind. The total amount of energy produced would be exactly equivalent to the energy consumed."

"Yes," cried Pep triumphantly, "but you yourself created the energy that moved your arm!"

"Nothing of the kind!" returned the doctor. "The energy that moved my arm was derived from my food. It was stored up in the meat or vegetables I had eaten. Plants store up the energy of the sun in the form of carbon. Animals eat the plants and can then use this energy that has been stored up in the form of starch, sugar or other carbon compound. Every time you move, Miss Pep; every time you think; every time you feel an emotion; the power that moves your muscles, that works your brain or that quickens your pulse is nothing but stored-up sunlight, bottled up in the green tissues of plants.

"It is the sunlight of by-gone ages, stored up in coal or petroleum, that runs our trains, our steamers and our automobiles and that heats and lights our houses today! Even the power from our water-falls and windmills is nothing but the sun's energy in another form."

"Is that what you mean by saying that all motion is perpetual?"

"Yes. Everything in this universe is constantly in motion. The stars in the skies are all moving. The earth with everything on it has a three-fold rotation—it revolves daily around its axis, yearly around the sun, and with the sun it journeys through unknown portions of the heavens. Nor is this all. Chemistry teaches us that the atoms and molecules of every grain of sand are also in rapid movement. In a word motion is perpetual—everywhere—nothing is ever at rest!"

"Then why is it," questioned Pep, "that people say that 'perpetual motion' is impossible?"

"They refer to what are known as 'Perpetual Motion Machines'—that is to say, machines that once given a start, would keep on running forever. In a machine there is always friction, and friction changes a portion of the energy into heat, which although not lost, is dissipated into space, and hence lost to the machine. We may by new inventions greatly reduce the losses by friction, but we can never entirely eliminate them.

"Besides this loss by friction, there is also another loss. Every useful machine does 'work,' and in performing this work, a portion of the energy is also transformed into heat or sound or other useless vibrations. For example, in sawing a log, there is not only the loss by friction in the working parts of the machine itself, but there is the added loss caused by the friction of the saw as it makes its way through the timber."

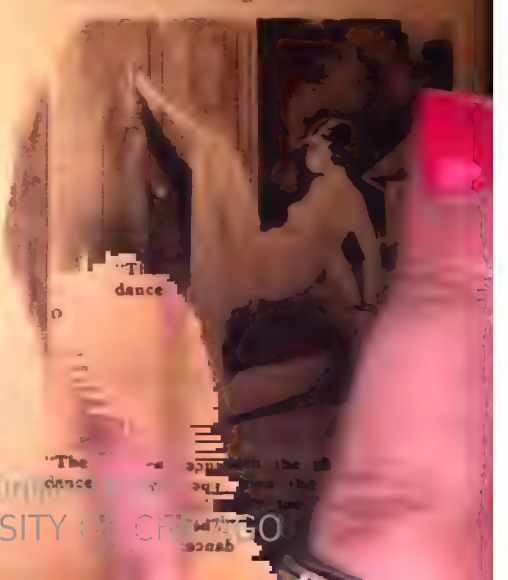
REAL PERPETUAL MOTION

"Then, if I understand you, perpetual motion is possible, but a perpetual motion machine is impossible?"

"I didn't say that. The statement must be qualified. Of course I am not speaking now of the host of 'Perpetual Motion' cranks who believe that by a suitable arrangement of magnets or floats on a wheel, the wheel may be made to revolve forever. These geniuses seem to forget that the power required to move the float or the magnet is greater than the power obtained, and hence there is always loss of energy. We see this in the dynamo, which is nothing but a series of shifting magnets on a wheel. But the dynamo, in spite of its high efficiency, consumes more energy than it gives out.

"When I was a boy of ten I invented the perpetual motion machine that every bright boy invents. I had two basins of water and I proposed, by means of one siphon, to siphon the water from one basin to the other; and by means of a second siphon to make the water flow back into the first vessel again. If I had succeeded, I should have had a real perpetual motion machine with the water constantly flowing."

"Wouldn't the thing work?"



"The [illegible] dance [illegible]"

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Secrets

FEZANDIE

of Perpetual Motion

"No, for the simple reason that you can only siphon off water from a higher level to a lower one, and both basins cannot be lower at the same time."

"Yes, but you can keep raising the full basin."

"Precisely, and in so doing you use more energy than the water can give in descending again. That's where the flaw lies. Here's a very similar scheme a man proposed to me this morning."

So saying, Doctor Hackensaw drew from among his papers a diagram.

The water in the upper closed chamber falls through the pipe B on the wheel W causing the wheel to revolve, and the water then flows back into the lower reservoir. As the water empties from B, a vacuum is formed on the upper reservoir and atmospheric pressure on the water in the lower reservoir is supposed to force it up into the vacuum, and so the stream will keep on flowing and turning the wheel forever. Simple, isn't it? All the work you want done at no expense!"

"It looks as if it would work," said Pep. "Where is the flaw?"

"Simply in the fact that the water wouldn't run out of B. It would run back through the long leg A instead. The scheme is ingenious, but so are many of those proposed. In fact, a number of perpetual motion machines slip into the patent office undetected, in spite of the efforts made to keep them out."

"But a water-wheel or windmill will keep on forever."

"Yes, but the force here is constantly renewed. It is the sun that furnishes the energy of the wind or the falling water, but the sun only does so at the expense of its own heat. The supply of energy must be constantly renewed and will result in the sun's ultimately becoming a cold dead mass.

"The same objection lies to self-winding clocks. There are clocks made which wind themselves daily through the change of temperature between the day-time and the night-time. Here, too, it is the sun's heat that supplies the loss of energy.

CATS AND RATS

"I might class in the same category the following attractive perpetual motion scheme which some genius sent to the White House during President Cleveland's administration. The idea was to establish a business for utilizing the fur of cats. The cats were to be fed on rats, and the rats were to be fed on the dead bodies of the cats after the hides had been removed. In order to compensate for the matter removed [illegible] skins, and for other losses, the [illegible] to be kept in a large enclosure in [illegible] air and the weed[illegible] would g[illegible] taneously would [illegible] the roo[illegible] more than enoug[illegible] make [illegible] deficiency.

"The business [illegible] itself a[illegible] matically at pra[illegible] expen[illegible] seemed millions[illegible] to [illegible] my belief, the [illegible] clined[illegible] ing offer.

"The joke o[illegible] ter [illegible] hat there is a[illegible] thing[illegible] the scheme. [illegible] be [illegible] a small sca[illegible] ge scale, for [illegible] on other an[illegible] the waste of[illegible] d, the sam[illegible] or the [illegible] s case als[illegible]

Instantly the machinery began to work, and Pep felt a strong current of air as the car, slowly losing its gravity, began to ascend in the guides.

derived from the sun's heat, the energy in this case being stored up in the growing plant."

"Gee, doctor!" cried Pep. "That's a dandy sch[illegible] all right! But it seems to me that all [illegible]y shows that a perpetual motion m[illegible] impossible?"

[illegible]ll, but our inventors are seeking [illegible]rong direction. No wheel or [illegible]loats will ever bring them what [illegible]ing for. The gist of the mat- A machine that does work, [illegible]nergy into heat. In order to [illegible]al motion, we must prevent the [illegible]aping and change it back into There is the problem in a

[illegible]ou succeeded in doing it?"

[illegible]ery limited extent. But while [illegible]periments the idea occurred to [illegible]ight find perpetual motion in [illegible]ecular forces—of which heat [illegible]ne manifestation. Here, too, however, my efforts have so far proved vain, although of course, until we know something more about atoms and molecules we cannot predict what surprises there may be in store for us. And then, all at once my thoughts turned to gravitation. Here was a source of energy which seemed inexhaustible, for we have no reason whatever for believing that the earth, in attracting another body, uses up any of its energy. Its attractive power seems just as great afterwards as before. Here, if anywhere, was the place to seek 'perpetual motion.'

"But I won't tire you with an account of my experiments. For some months past I have had an experimental machine under construction, up in the Adirondacks. I have just received word from my foreman that the machine is now finished, ready for the start. I am going to fly there this afternoon in my airplane, and if you want to come along you can yourself press the button that will start the machine going.

(Continued on page 702)

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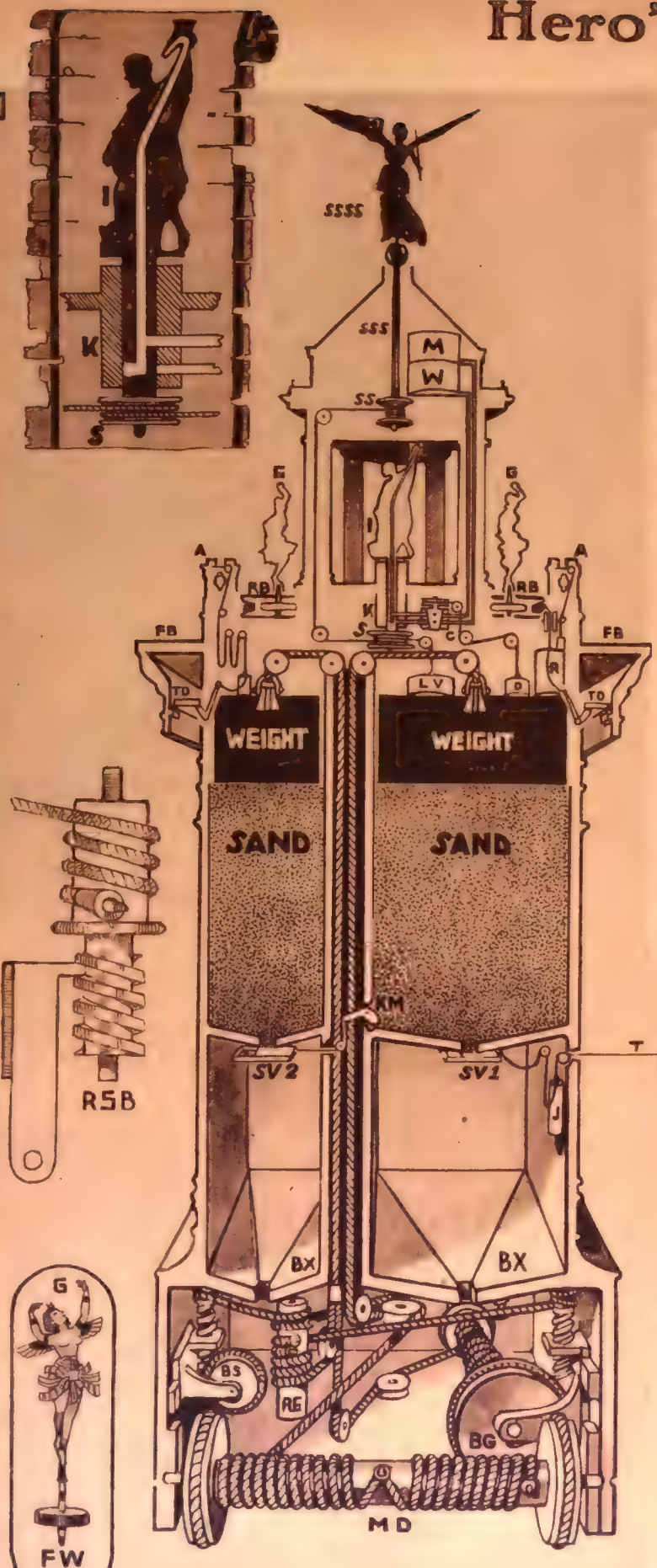
Hero's Automotor



PTOLEMY PHILADELPHUS, Prince of Egypt, graced the try-out of one of Hero's automatons. He saw the slender thread cut and the machine start off throwing flowers at his feet—while the peace emblem fell out, took wing and flew away. He noted the six dancing girls spin on their toes as they circled the temple: the Victory on the Dome whirling in another direction: the Bacchus slowly turning as he poured upon all sides alternately milk and wine and at the same time the two altars were belching forth perfumed smoke.

After the automaton had gone thirty feet it stopped, then it reversed and came back the entire distance and saluted the Pharoah with a shower of lotus blossoms. Then it seemed to rise, when it made a circle and saluted with myriads of humming birds, then it did a circle backwards and saluted by releasing one most beautiful white egret, at which Bacchus emitted a prolonged and shrill whistling wail.

In action the thread "ST" releases the weight and ratchet actuating axe which cuts thread "T" releasing a weight "J" whose fall opens slide valves "SV 1" allowing the sand to run out—which allows the weight in the largest compartment to fall slowly, its power is communicated by rope over two pulleys, thence downward, connecting with drum "MD" that actuates the drive wheels. After part of the drum "MD" is unwound a reverse winding is met that makes the drive wheels go backward. The weight "R" in falling rotates the roller bearing collar "RB" "RB" in which six friction wheels "FW" spin the girls "G" as they circle the temple. Weight "D," in falling, opens compound valve "C" controlling the two pipes from tank "M" "W" which contain milk, wine and compressed air held back by the rotary cut-off "K." Weight "LV" turns spool "S" rotary cut-off "K" as well as "I," the Bacchus—the three which are one piece of metal. The cord from "LV" after leaving "S," the spool, goes to bobbin "SS," where its unwinding rotates the Victory statue, "SSSS" through shaft "SSS." When the large weight nears the end of its trip it unhooks from the drum "MD" and trips the cam "KM," which opens slide valve "SV 2," releasing sand and making the small weight through its rope connection to

(Continued on page 715)

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Dating 200 B. C.

By Charles B. Bunnell

THE automaton made famous by Hero's writing was one of the mechanical marvels of ancient times. It ran straight, reversed itself, described circles, tossed out flowers, released a dove, was encircled by dancing girls, carried a figure of Bacchus, which poured forth alternately milk and wine, and was surmounted by Winged Victory, which revolved constantly. Upon one occasion it entertained one of the great Pharoahs or kings of Egypt, shortly after that famous figure inquired after a royal road to mathematics, and was told it did not exist.

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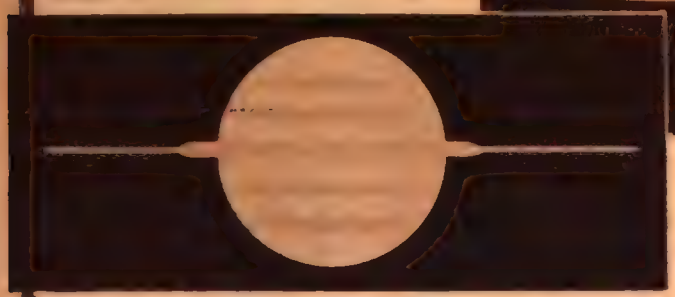
The Problem of Saturn's Rings

HOW scientists prove the fact that Saturn's rings are composed of thousands of small particles, and that the planet was not composed of one solid mass, but rather of a number of concentric shells with those on the interior revolving more swiftly than the outer ones, makes an interesting story. Galileo was the first to notice a peculiarity concerning the planet. He thought, however, that what later proved to be the rings, were merely two huge satellites. It was not until very recently that the facts concerning the planet, its composition as well as the composition of the rings, and various peculiarities which make themselves manifest from time to time, have been thoroughly understood. Scientists are working constantly on the many problems.



The most surprising discoveries concerning the planet were made with a spectroscope. With the aid of this instrument, it was definitely proven that the rings consisted of small particles, and that the inside of the rings revolved more swiftly than the outside. In the realm of pure mathematics, Professor Lowell at the Flagstaff Observatory, Arizona, proved that the attractive effects of Saturn's moons would leave the rings with various gaps in them. This computation was made chiefly in connection with the two largest ones. It is a well-known astronomical law that where two bodies rotate at periods which are multiples of each other, one of the two bodies must change its orbit. The small sketch shown just under the cross-section illustration gives the result of Prof. Lowell's computations. The dark spaces show where gaps had to occur according to mathematics. The gaps shown at 17 is Cassini's division, and that at 20 Encke's division. However, when these calculations were checked up against observations, it was found that the divisions were shifted slightly away from their actual position, as observed. This led to the postulation of the theory that Saturn was not a solid planet as previously supposed, but a system of concentric shells, as shown in the large illustrations above, with the inner shells revolving more swiftly than the outer ones. When the mathematics were rechecked on this theory, coincidence between observation and calculation was found perfect. At different times observers had noted slight irregularities in the thickness of the rings. Upon carefully noting the position of these thicknesses and checking them up against the gravitational lines of force from the various moons, it was found that these enlargements were always in the field of greatest gravitational strength.

STAR SEEN DULLED THROUGH OUTER RING
STAR FLICKERED TWICE
SATURN
SATURN
SATURN
SOLID BODY SHATTERING DUE TO GRAVITATIONAL PULL FORMING RING
PARTICLES ON INNER RING MOVE FASTER THAN THOSE ON OUTER
STAR SEEN BRIGHTLY THROUGH CASSINI'S DIV. AS IN OPEN SKY
A
B
C

By observing the passage of a star behind Saturn's rings and noting its comparative brilliancy as it passed from one division to the next, it was proven conclusively that Cassini's division was an actual division, and that the Crape ring was thinner than the others. Also, since the star was not observed to flicker it followed that the particles within the ring had to be three hundred feet or less in diameter, so as not to subtend sufficient arc to cut off a view of the star, thus causing it to twinkle.

After complete study of all the conditions and observations, scientists believe that the rings were formed by the shattering of some other body passing in close proximity to the planet. It was calculated that no solid body could exist near Saturn if its distance were less than 2.38 times the radius of the latter. Since such is the case, and since it was definitely proven that solid matter could not exist so close to the planet, it was postulated that some solid body was shattered into small bits, thus forming the rings. A number of observers have recently brought forth claims that another outer ring exists at the edge of the present ones. Such a ring is required by a mathematical theory, and one or two famous observers have brought forth claims of having seen it. However, as yet there is not sufficient observation proof to make its existence accepted.

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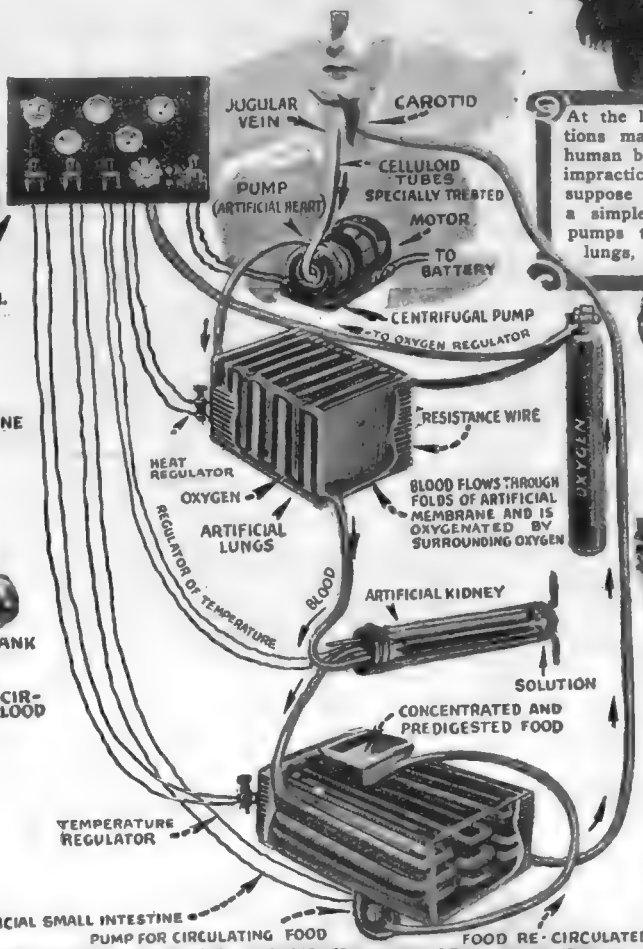
The Artificial Man

Removing the Fangs of Death by Substituting Organs of the Body Which Have Succumbed to the Effects of Time and the Ravages of Disease.

By JOSEPH H. KRAUS and H. WINFIELD SECOR

Miss Fannie Brice before and after surgeons reshaped her nose.

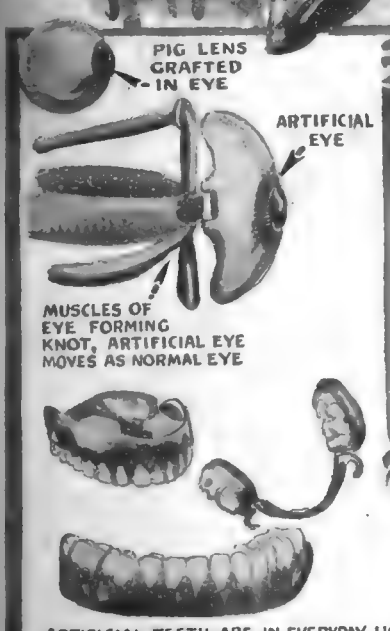


At the left we see the various substitutions made for different organs in the human body. These methods are not as impractical as one might at first glance suppose them to be. The heart pump is a simple double valved mechanism; it pumps the blood through the artificial lungs, and consequently replaces both.

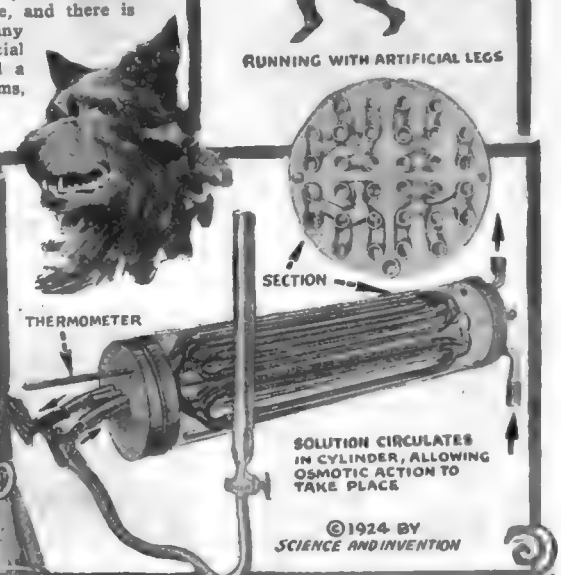
PLAYING CARDS WITH TWO ARTIFICIAL ARMS

RUNNING WITH ARTIFICIAL LEGS

You have all read of the eye lens of a pig which was grafted into a boy's eyeball. Artificial eyes are frequently found which rotate and move the same as the natural eye, and there is nothing new in artificial teeth. Victims of many accidents have shown us how to use artificial arms. The authors have seen a man thread a needle who was equipped with two artificial arms, and men racing who had artificial legs.



ARTIFICIAL TEETH ARE IN EVERYDAY USE



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And now comes the announcement that Dr. John J. Abel, Professor of Pharmacology at the famous Johns Hopkins University Medical School, has invented an "artificial kidney." The photograph of the kidney is shown above and to the left is Dr. Abel in his laboratory. This artificial kidney was tried out on dogs and it is soon to be employed on human beings who might be suffering from corrosive sublimate or other similar poisons. The cylinder is of glass and contains a number of celloidin tubes, which strains the poisons out of the blood and simulate the action of the kidneys. The device is attached to an artery and a vein. The time will soon be forthcoming when the organs of man may be made artificially and glandular fluids will be injected into the blood constantly.

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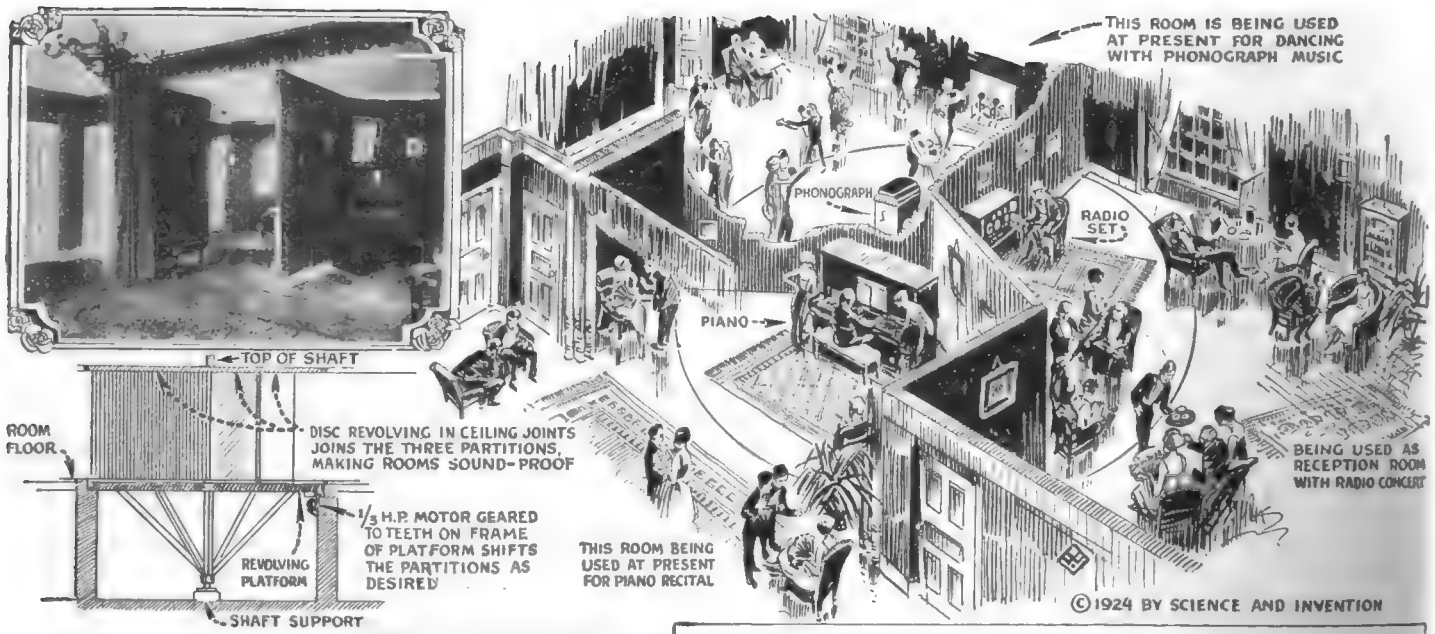
Making One Room Into Three


THIS ROOM IS BEING USED AT PRESENT FOR DANCING WITH PHONOGRAPH MUSIC
PHONOGRAPH
RADIO SET
PIANO
TOP OF SHAFT
ROOM FLOOR
DISC REVOLVING IN CEILING JOINS THE THREE PARTITIONS, MAKING ROOMS SOUND-PROOF
1/3 H.P. MOTOR GEARED TO TEETH ON FRAME OF PLATFORM SHIFTS THE PARTITIONS AS DESIRED
REVOLVING PLATFORM
SHAFT SUPPORT
THIS ROOM BEING USED AT PRESENT FOR PIANO RECITAL
BEING USED AS RECEPTION ROOM WITH RADIO CONCERT
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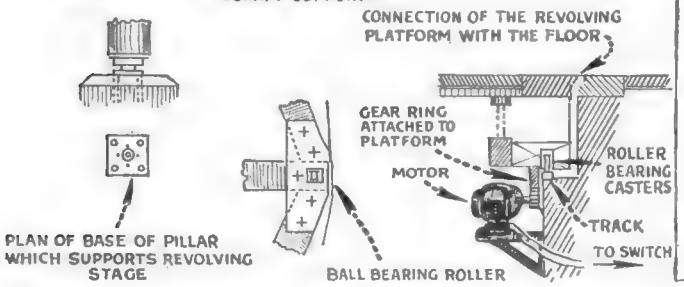
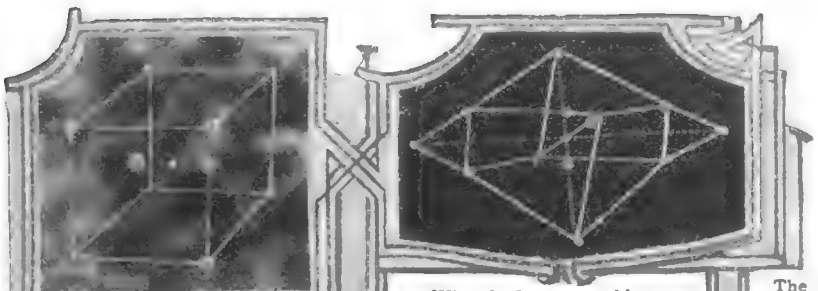

CONNECTION OF THE REVOLVING PLATFORM WITH THE FLOOR
GEAR RING ATTACHED TO PLATFORM
MOTOR
ROLLER BEARING CASTERS
TRACK
TO SWITCH
PLAN OF BASE OF PILLAR WHICH SUPPORTS REVOLVING STAGE
BALL BEARING ROLLER

GERMAN architects have recently evolved the idea of opening all the rooms of the floor of a house into one large apartment. The system is based on installing a turn-table at a convenient corner, where three or more rooms meet. By mounting the turn-table, so that it can be shifted with ease by the use of a small electric motor, the walls may be so turned that the three rooms can be converted into one. A dining table may be installed in one of the compartments, a piano may be placed in the middle. In such a case it would only be necessary to press a button revolving the turn-table in order to shift from the dining room to the parlor. The mechanism is simple.

Model Shows Atomic Forms

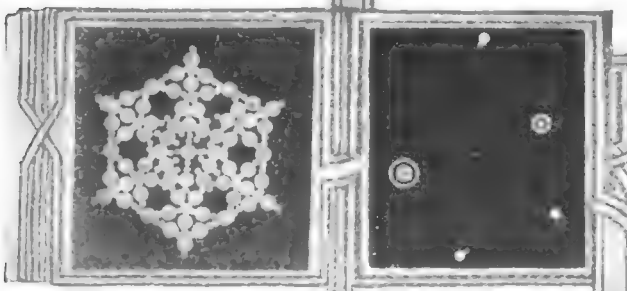


Above is shown a model of the oxygen atom with two of its corners blank. In the center is the nucleus around which revolve the eight electrons of the atom.

When hydrogen combines with oxygen, the two hydrogen nuclei are assumed to place themselves in the unoccupied corners of the oxygen atomic structure, as shown above.

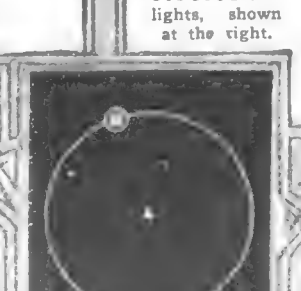
At the left the revolving atomic form model together with the switches which light the various lamps.

The General Electric Company have in their laboratories constructed an atomic model of circles and lights, shown at the right.



Above is shown highly magnified an ordinary snowflake, illustrating how the crystalline form composes itself symmetrically about a ...nter, reminding us very ... of distribution in ...mic structure.

Two hydrogen atoms unite to form a single molecule. The complete arrangement follows somewhat the shape given above.



The hydrogen atom the simplest known, consists of one electron revolving about its nucleus, as illustrated above.

The point of a pin allows a billion, billion molecules to rest comfortably upon its point.

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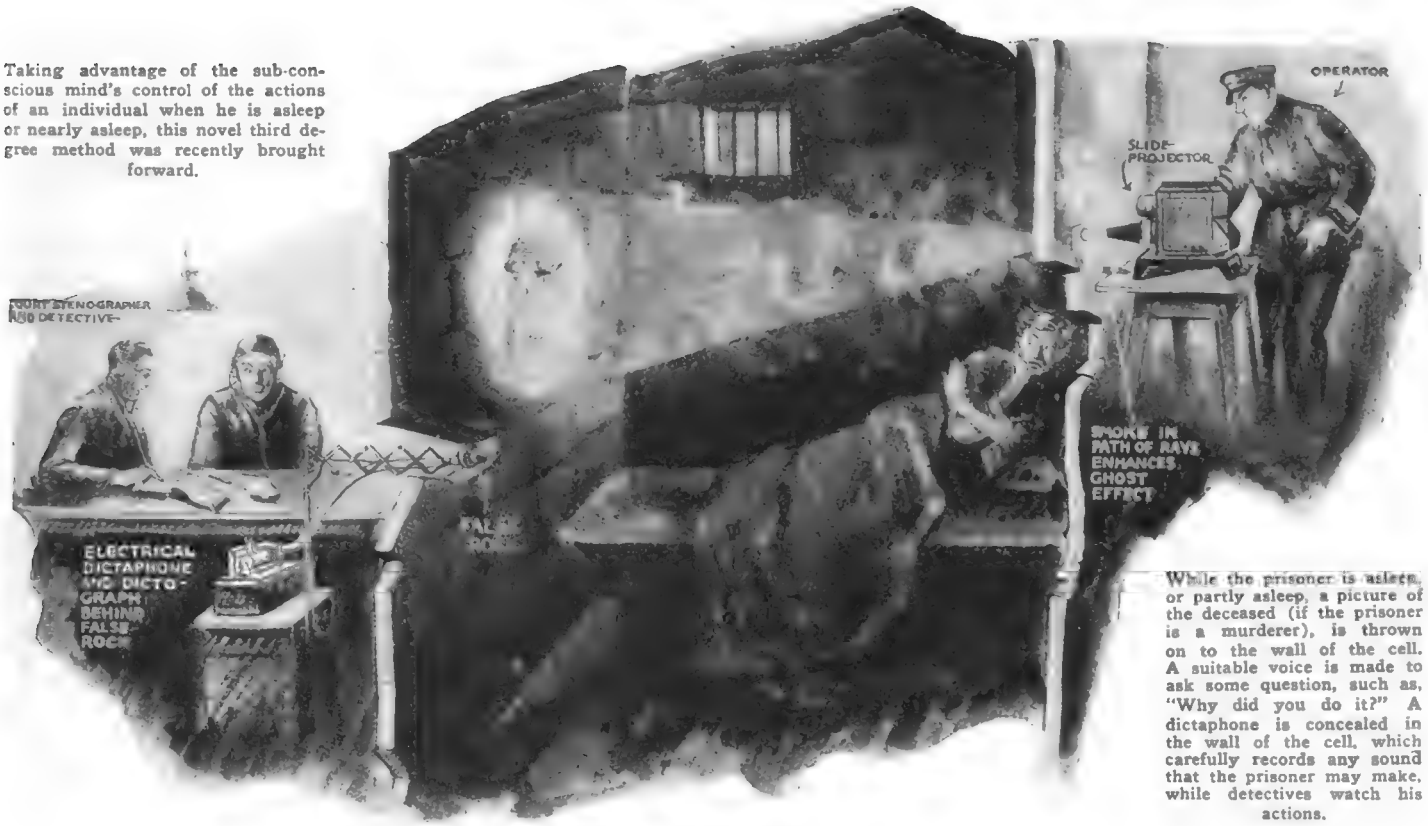
A Novel Third Degree Method

By ANDY GILBERT

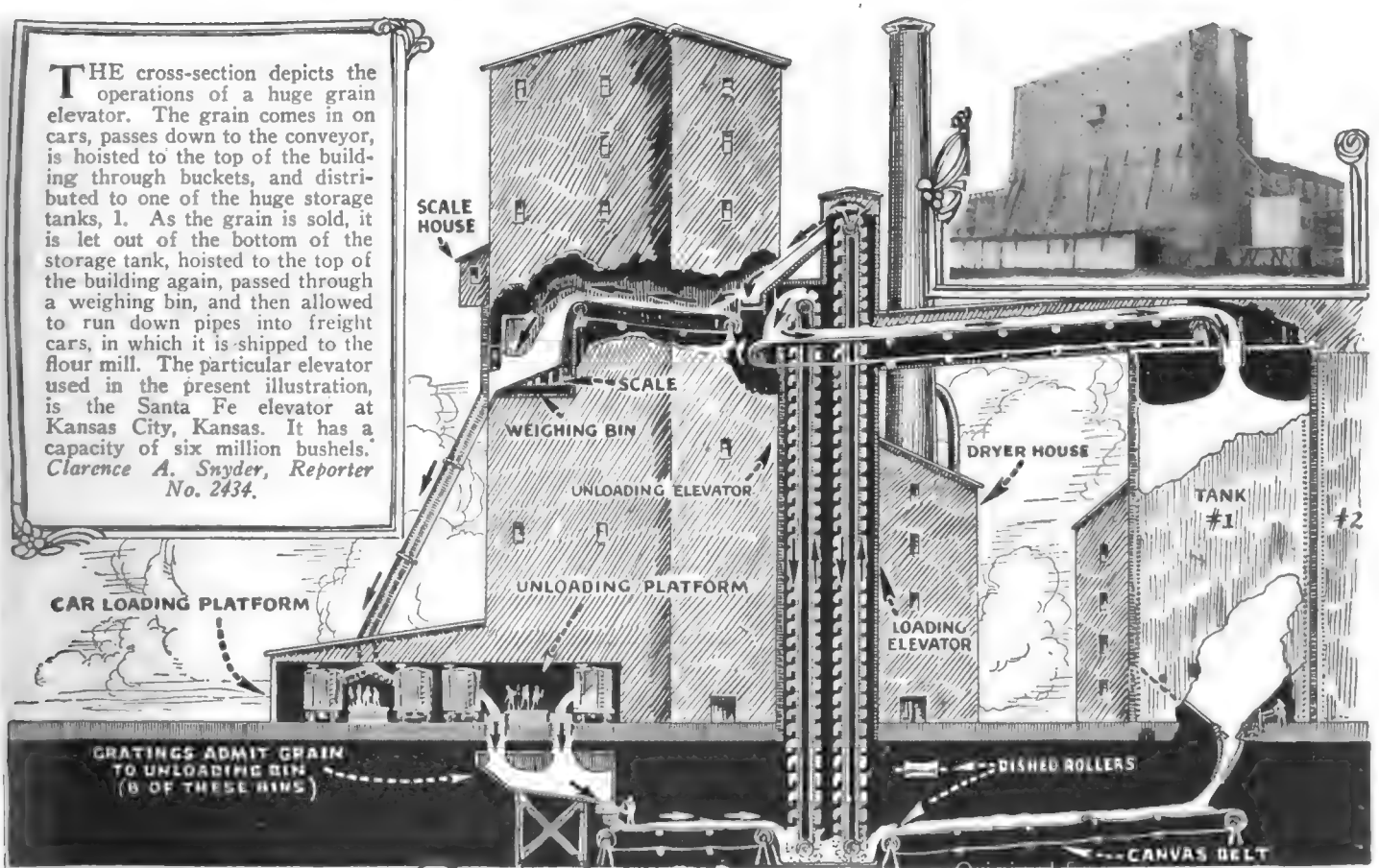
Taking advantage of the sub-conscious mind's control of the actions of an individual when he is asleep or nearly asleep, this novel third degree method was recently brought forward.


OPERATOR
SLIDE-PROJECTOR
COURT STENOGRAPHER AND DETECTIVE
ELECTRICAL DICTAPHONE AND DICTOGRAPH BEHIND FALSE ROCK
SMOKE IN PATH OF RAYS ENHANCES GHOST EFFECT

While the prisoner is asleep, or partly asleep, a picture of the deceased (if the prisoner is a murderer), is thrown on to the wall of the cell. A suitable voice is made to ask some question, such as, "Why did you do it?" A dictaphone is concealed in the wall of the cell, which carefully records any sound that the prisoner may make, while detectives watch his actions.

Handling the Nation's Grain

THE cross-section depicts the operations of a huge grain elevator. The grain comes in on cars, passes down to the conveyor, is hoisted to the top of the building through buckets, and distributed to one of the huge storage tanks, 1. As the grain is sold, it is let out of the bottom of the storage tank, hoisted to the top of the building again, passed through a weighing bin, and then allowed to run down pipes into freight cars, in which it is shipped to the flour mill. The particular elevator used in the present illustration, is the Santa Fe elevator at Kansas City, Kansas. It has a capacity of six million bushels. *Clarence A. Snyder, Reporter No. 2434.*



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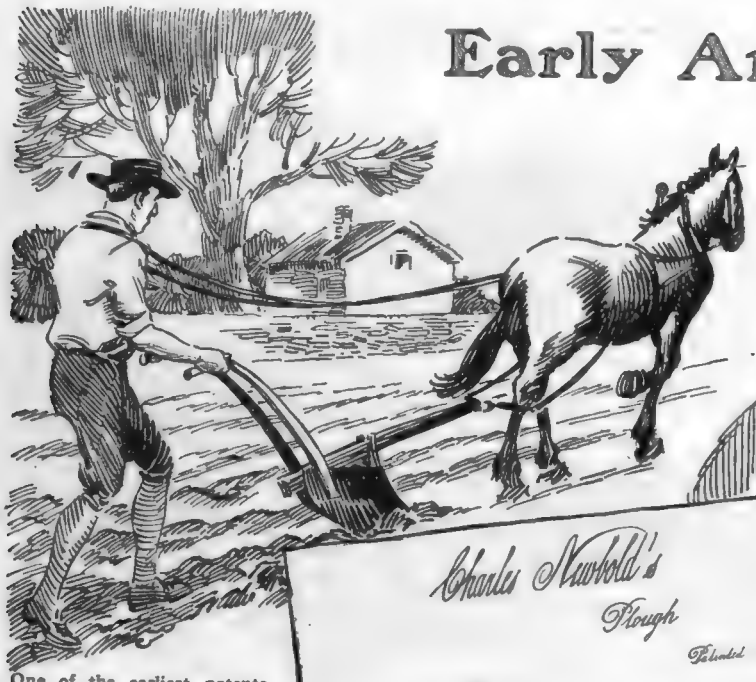
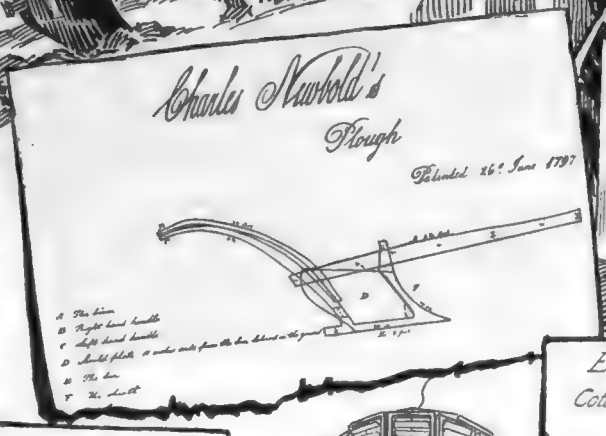
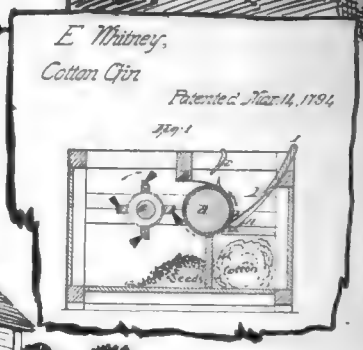
Early American Patents

Early Mechanical History Told by the Patent Office

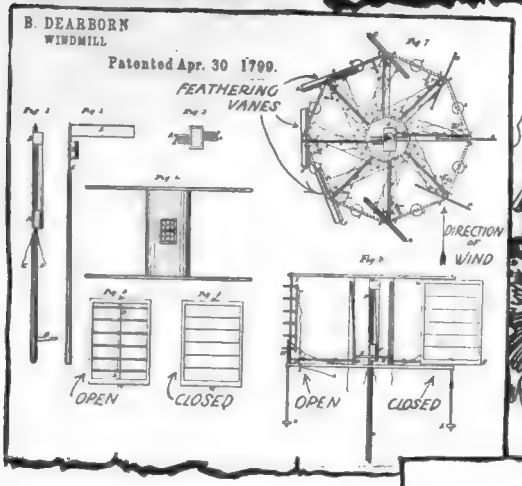


One of the earliest patents on record dated June 26, 1797, covers the construction of the ordinary turn plow. The same principle, incorporated in the share of this implement, is used today by every farmer; the construction of the turn plow has changed little since the issuance of this early patent.

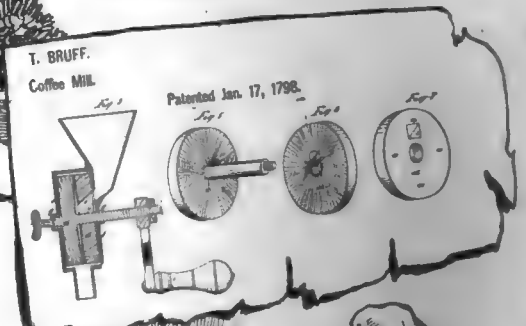


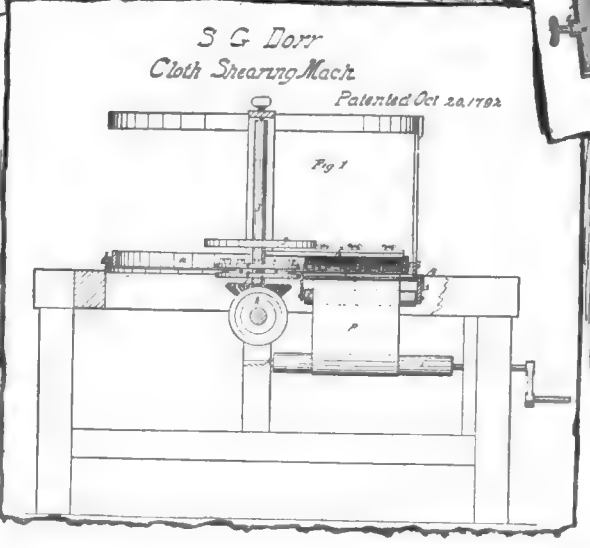


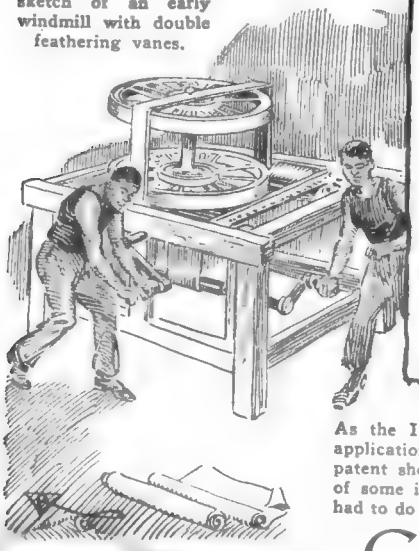
Probably the most important patent in the history of the United States before the last fifty years was that covering Eli Whitney's cotton gin. The illustration at the left is a copy of the original patent drawing, as are all the others on this page. The gin changed entirely the economic situation of the Southern States.



Even in those days the inventors were already at work upon the solution of the great problem involved in making the power of the wind useful to man. Above is shown a patent sketch of an early windmill with double feathering vanes.







As the Industrial Revolution was ushered in principally through the application of mechanics to the manufacture of cloth and clothing, the patent shown above covering the design of a cloth shearing machine is of some importance in our history. A large part of the early patents had to do with agricultural or weaving machines of some sort or another.

The father of our present day coffee mill was patented in 1798 by one T. Bruff, a sketch from his original patent paper showing the assembly of the burrs and the method of feeding the mill is given above.

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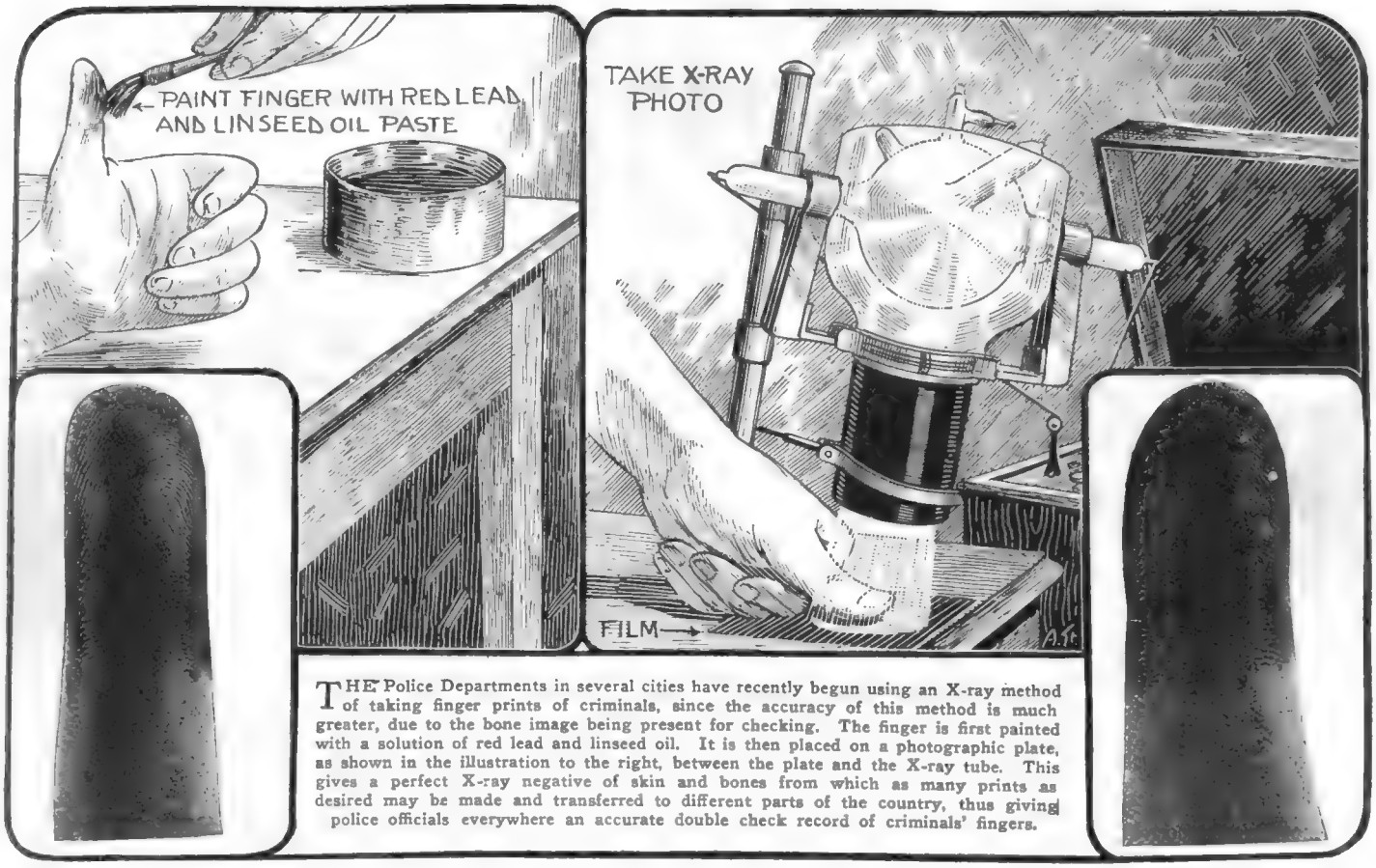
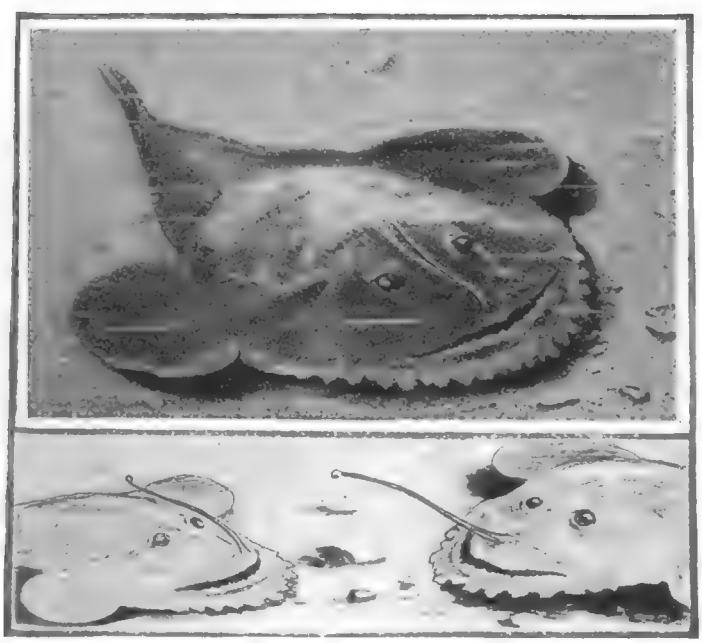
X-Ray Finger Prints



THE Police Departments in several cities have recently begun using an X-ray method of taking finger prints of criminals, since the accuracy of this method is much greater, due to the bone image being present for checking. The finger is first painted with a solution of red lead and linseed oil. It is then placed on a photographic plate, as shown in the illustration to the right, between the plate and the X-ray tube. This gives a perfect X-ray negative of skin and bones from which as many prints as desired may be made and transferred to different parts of the country, thus giving police officials everywhere an accurate double check record of criminals' fingers.

The Angler Fish



THESE strange fish, shown above, subsist in the easiest possible way. Its wide mouth acts as a trap in which it catches smaller fish at play. It is also equipped with a unique frontal filament, which dangles in front of its nose attracting prey. This filament also has the property of glowing when the fish makes a trip into the darker and lower regions of the sea. It comes close to land in shallow water only in spawning season. After eating this fish selects a warm spot near the surface of the water at the edge of a shallow bay, where it basks until its stomach full of food has digested, when it fares forth again in search of prey.

—Photo Copyright Dr. W. H. Ballou.

Corpuscles Circle Earth

If all the red corpuscles in the human system were placed end to end, they would make a chain which would encircle the earth more than three times. —Kosmos.

Head Radiator

One of the most novel of the devices put on the market during the past few months is that illustrated at the right. As noted, it can be placed around the head, and it is also manufactured to be superimposed over the heart. The little metal vanes act as radiators of the bodily heat. They say it actually works!

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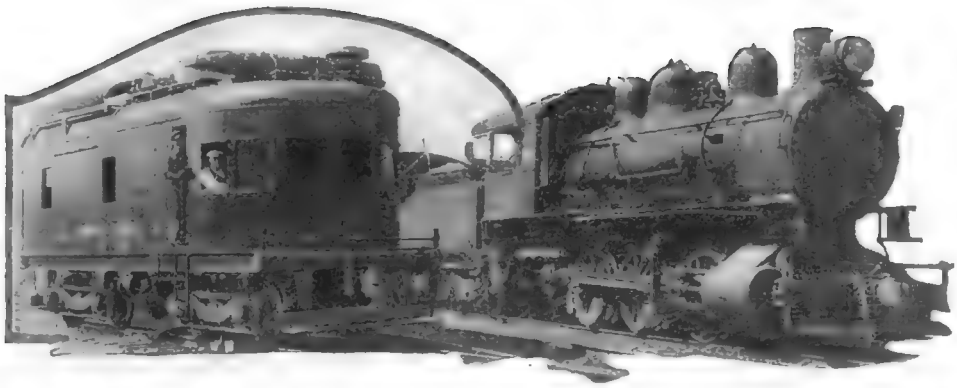
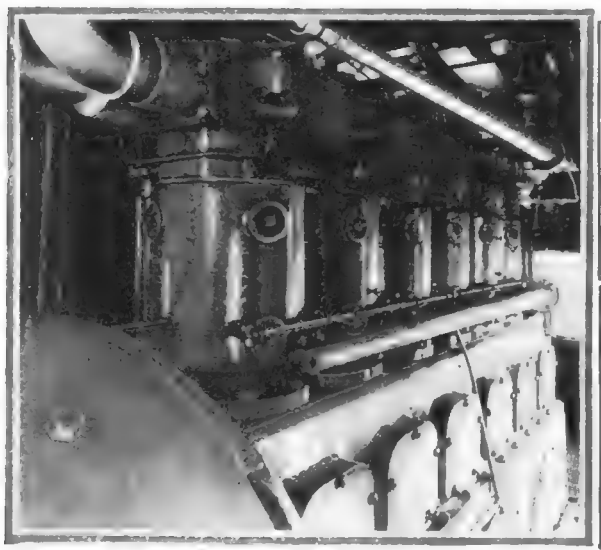
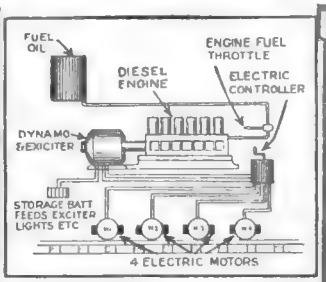
Oil Motored Switching Locomotive

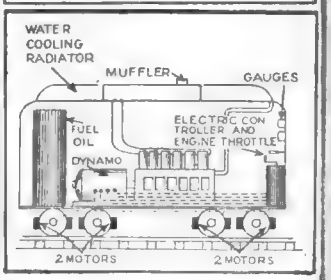


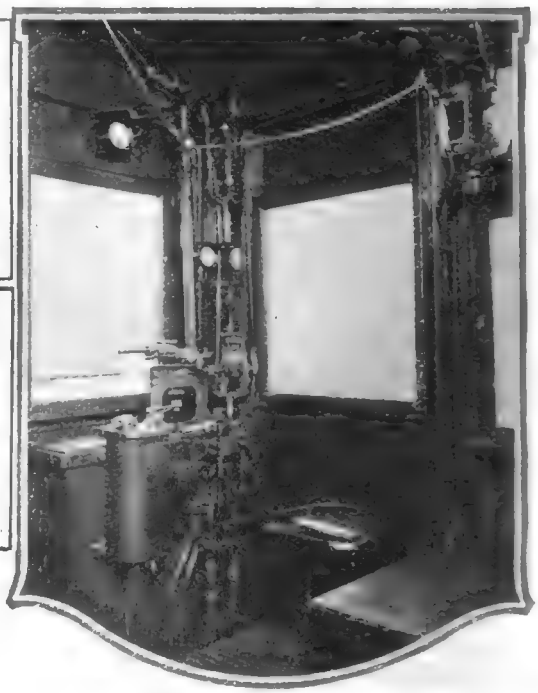
A New York concern has just brought out a new type of locomotive using crude oil as fuel, which is entirely smokeless and noiseless in operation for use in switching around large cities where the ordinary steam locomotive causes a disturbance. At the left is a view of the new locomotive compared with a standard type of the same power.

—Photos Ingersoll Rand Co.





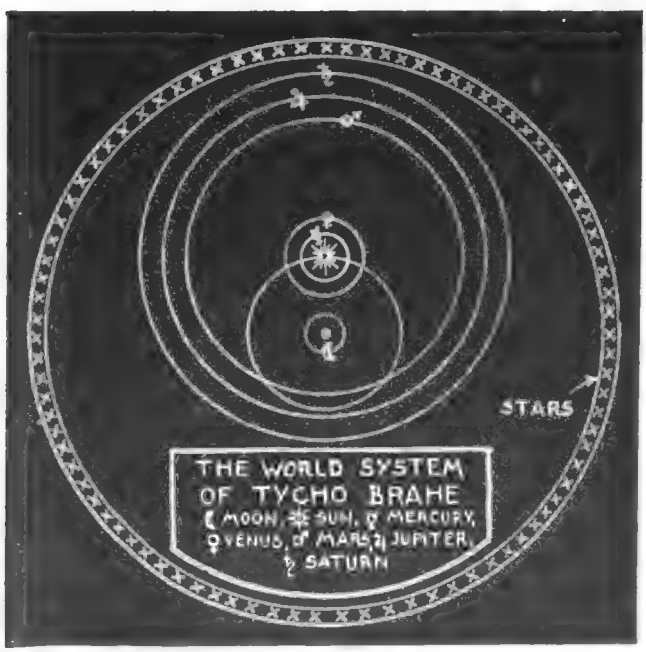




By examining the sketches and photographs above, a clear idea as to the method of operation of this new locomotive may be gained. A six cylinder semi-Diesel engine is directly connected to a suitable generator and exciter. The generator is wired directly to the engineer's control box and to four motors of the trolley car type, which are attached directly to the axles of the wheels. The engineer also controls the flow of fuel to the engine. Since the consumption of fuel is pretty well proportional to the power used, little adjustment of this throttle is necessary.

—W. B. Arvin

The Work of Tycho Brahe



TYCHO Brahe, the instructor of Kepler, evolved an astronomical idea of his own which is shown in the sketch to the left. He conceived the earth as fixed in the center of the universe. Around it revolved the sun and the moon, and the planets in turn revolved around the sun. The fixed stars were of course in a band outside the movement of the planets. Some of his best work was done with the aid of the two huge sextants shown in the photograph at the right. It was his opinion that astronomy could only make great advances through the aid of accurate measurements made with the aid of sensitive instruments and a telescope. He lived between the years 1546 and 1604.—*Hubert Slouka, Reporter No. 7110.*

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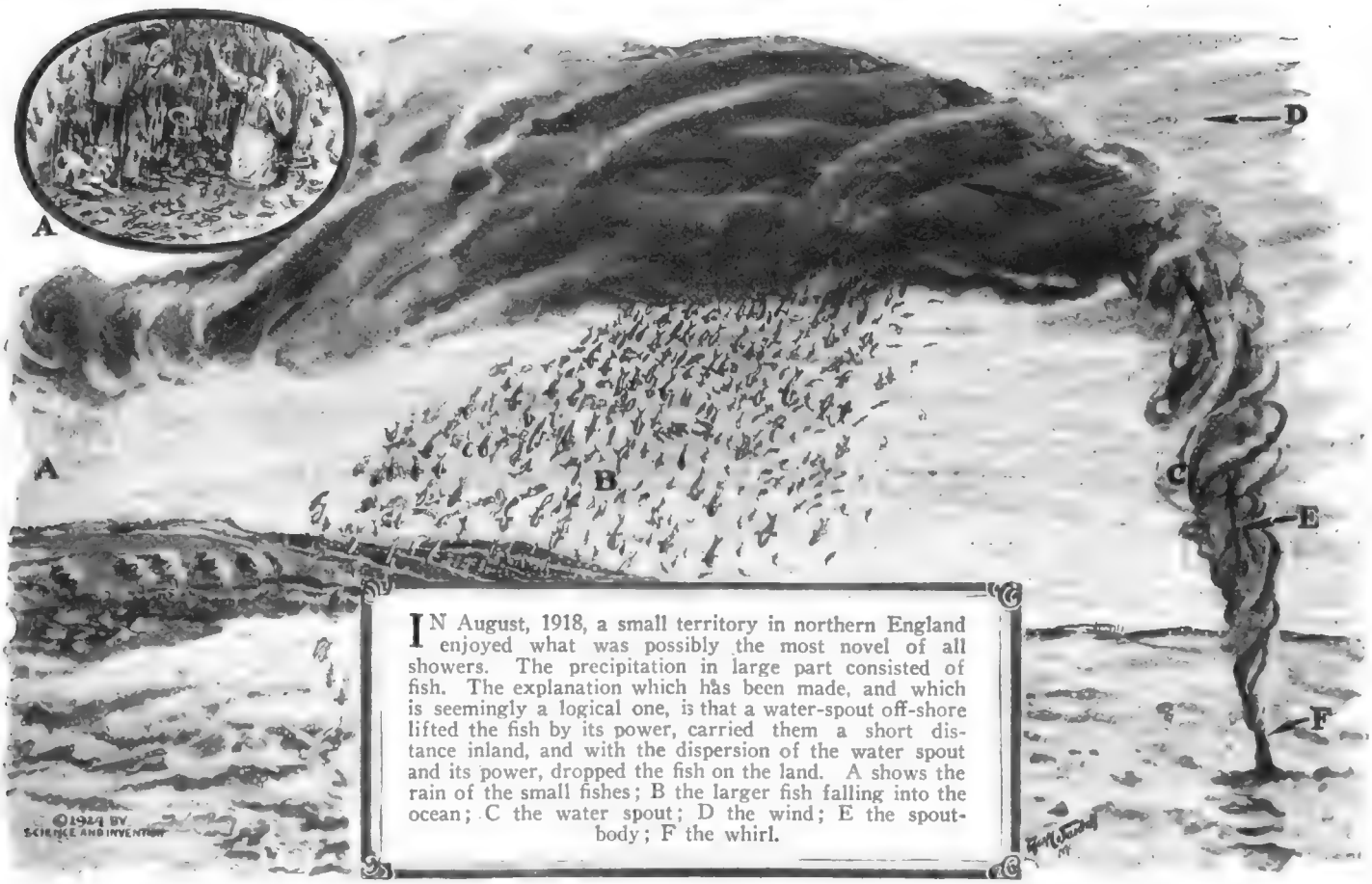
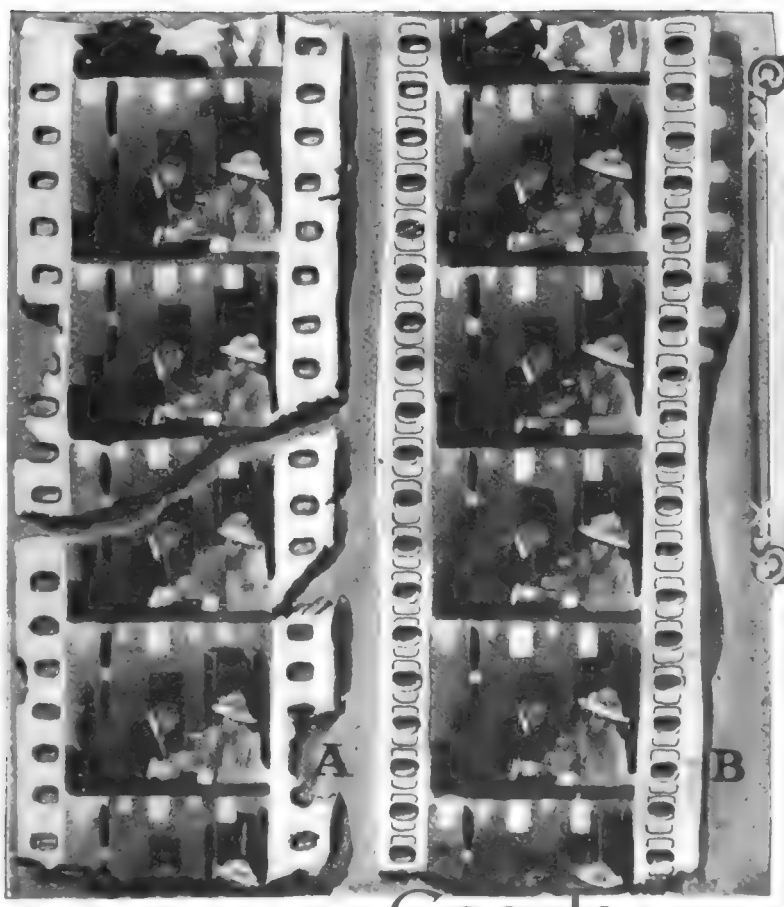
A Rain of Fish



IN August, 1918, a small territory in northern England enjoyed what was possibly the most novel of all showers. The precipitation in large part consisted of fish. The explanation which has been made, and which is seemingly a logical one, is that a water-spout off-shore lifted the fish by its power, carried them a short distance inland, and with the dispersion of the water spout and its power, dropped the fish on the land. A shows the rain of the small fishes; B the larger fish falling into the ocean; C the water spout; D the wind; E the spout-body; F the whirl.

Prolonging the Life of Films

Below is shown a view of the film-facing machine, which attaches the small copper ribbons to the sides of the film. The work is quickly and accurately done.



ONE of the most costly divisions of moving picture production and projection is the constant wear at the sprocket holes in the side of the film. A Philadelphia inventor has recently brought out a novel means for prolonging the life of the film by binding small strips of thin copper along the edge of the film, thus giving a positive hold for the gear and preventing excessive wear. Both faces and both edges of the film are protected by the copper, the opposite sides being clamped through, so that the strongest possible construction results. It is claimed that this method of preserving the film will save many thousands of dollars in extra positives, which have been required in the past.

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Readers Forum

WHAT HE LIKES

Editor, *Science and Invention:*

I am an old reader of your magazine; my attention having been attracted, a few months ago, to one of your popular articles on Astronomy, in which subject I am much interested, though the veriest tyro. But, I have followed your magazine for a few months, and am glad to say that I believe your new issues are a great improvement on what was already a vastly interesting publication.

Although your magazine is manifestly intended to be popular, and is not written for the professional scientist, nor the professional engineer, yet, it is filled with interesting things which the dryest professional may find joy in reading, and brings to his attention a host of things which might otherwise escape him. I have been very glad to note the generally high degree of accuracy with which you present scientific matters popularly. (This does not apply to your fiction.)

Your sub-divisions of subjects are admirable. I feel sure that your PRIZE CONTESTS will bring to public notice very many interesting and useful things, which would otherwise have remained dormant. The Editor of THE ORACLE has a hard row to hoe as a matter of course, but he is making his department interesting now, and I have a feeling that he will make it increasingly so.

Allan V. Garratt,
Boston, Mass.

A BOUQUET

Editor, *Science and Invention:*

Perhaps my opinion will not be of a great value. Nevertheless, I dare to say I know how to make a distinction between what is worth while and what is not.

Rather inexpert as I am in the art of writing, of expressing my ideas before a public so well cultivated, as the American public is, or in seeing my thoughts printed in a valuable issue, rightly I fear how weak any of my phrases will be, which attempt to add any more fame and merits to the wonderful monthly magazine, SCIENCE AND INVENTION.

Some time ago while in a magazine store, on casting a glance upon the titles of the newspapers and magazines; the title which really struck me the best was the name of your very well known review. But my interest and surprise was a good deal greater, when I opened it, read some of the articles and saw some of the engravings contained in it. Since then it is my favorite friend and I have become a devoted, passionate reader of this review which was published before under another name, but today, this Golden title and cover is in accordance with what is in the magazine.

Carefully I turned over its pages, read each one of its articles and looked at the very well arranged, illustrative scientific pictures contained in it.

Today when we are in the century of Science and Invention, nobody who has a real sense of investigation in the causes which produce such marvelous effects in the way of scientific inventions and discoveries can be uninterested in reading it. The people in general, when they see an object that the discoverer or scientist offers to their service, ask themselves,—"What is the use of it; what can be done with it and how can it be employed?" And they are right. The real wise man, who pays attention to the infinite truth of things goes into the study deeply. He first makes his acquaintance with the object. But he doesn't stop here, he tries to go further and further in knowing the intimate cause of it, how it has been produced and what it can do.

Now you offer to the public, within the reach of everyone the easy acquirement of much scientific knowledge, that in other ways it would be very difficult to obtain.

Who is eager to enlarge and heap the treasure of his knowledge must go and drink in the pure and true stream of science to acquire what may be called real and meritable knowledge of the present and the tremendous progress of science.

A. G. Gutierrez,
Cincinnati, Ohio.

(Mr. Gutierrez, the writer of the letter printed above came to these United States but two years ago. No doubt many of us think that Mr. Gutierrez has over-estimated the virtues of the publication. Let us hear what some others have to say.—Editor.)

SUGGESTIONS ARE IN ORDER

Editor, *Science and Invention:*

There are some things I approved of in SCIENCE AND INVENTION and some that I do not.

Your idea of putting the magazine in pictures is all right, for the popular scientific articles, but not for the Constructor and How-To-Make-It Departments. Please don't make another *popular magazine* out of your magazine.

There are several magazines which give the latest news in science and mechanics, but not the old romance of discovery that has led up to it of which modern man knows so little. You could have a page every month showing step by step, as motion picture cartoons (or as in the comic sections of newspapers) the creation of the Universe by the nebular theory; The coming of life (with microphotographs); The life and death of prehistoric monsters; geology, archaeology, palcontology, anthropology and other subjects which you barely touch upon.

SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them in both palatable and unpalatable forms. So if you have anything to say, this is the place to say it in. Please limit your letters to 500 words and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 53 Park Place, New York City.

Also why not have a page each month with pictures of some room in a museum, for instance "The Hall of the Age of Man" in the American Museum of Natural History or the First Egyptian room in the Metropolitan Museum of Art?

And again those covers! When I look at your July and August issues it looks like the covers at least are not in keeping with the improved magazine.

Why not have some covers such as never appeared on the magazine before, such as a microphotograph of diatoms in colors, disease germs, or the head of an insect; A quarter of the moon hanging down with its numerous mountains; A streak of lightning, queer animals, plants, fishes, spectroscopes, mighty telescopes, prehistoric animals and human life, ancient ruins, scenes in the Ice Age, and surgical operations? I believe if you would put the things I have mentioned up to a vote, you would find many that think the same as I.

C. E. Payne,
Gerber, California.

(Many of the covers you suggested are found on issues of this publication, which are several years old. There are but very few readers interested in some of the subjects you mention and many of the "facts" are still open to argument. We will appreciate comments from other readers. —Editor.)

The Experimenter

has come back! If you are one of the one hundred thousand readers of the old ELECTRICAL EXPERIMENTER, you will no doubt be glad to hear that the EXPERIMENTER is coming back BIGGER AND BETTER THAN EVER. Beginning with the November issue PRACTICAL ELECTRICS has been changed into an entirely new kind of magazine entitled

The Experimenter

In this magazine which has been greatly enlarged in point of contents, illustrations and circulation, you will find the following new departments:

Experimental Radio
Experimental Chemistry
Experimental Electricity.

There is an entirely new treatment of radio containing experiments only. *90% of the magazine contains pure experiments* written by the foremost authorities in their respective fields, also a monthly editorial by the writer.

A fine roto-gravure section is now added to brighten up the magazine. *If you want experiments, this is your magazine.*

Be sure to reserve a copy from your news-dealer before the issue is sold out. THE EXPERIMENTER will be on sale at all newsstands beginning October 20th 1924.

Hugo Gernsback
Editor

EVOLUTION

Editor, *Science and Invention:*

Did you ever look all around the room, looking for your glasses, only in the end, to find them comfortably reposing on your nose? Did your wife or sister or daughter ever tell you about the time she looked everywhere for her thimble, only to find that it was on her finger all the time? Did you ever hook up a radio set, and when you tried it out, find that it would not work, and after long and irksome hunting, find that the trouble is some silly little thing, that you wonder how in the world you could have been stupid enough to do? I have no doubt that you have had all of these experiences; we all have, and when we go back over them, if we really stop to think, we cannot help but wonder at how simple the thing was after all, if we had only known the truth about it. How wonderful and simple truth really is, when we see it!

I have just read and re-read your editorial entitled "Evolution" in the January issue of SCIENCE AND INVENTION and have been struck with wonder and astonishment at what you have to say; not that what you have to say is new to me, but that such things should be set forth as facts, in a magazine that purports to be scientific. "Those who refuse to go beyond fact rarely get as far as fact."—Huxley. That is very true, but it is also very much more true that those who refuse to stop at fact, but continually go beyond it, rarely recognize it as they go past. In other words, in our search for fact and truth, it is much more common to fail to see the truths that are right under our noses and search for them in the far off distance, than it is not to look far enough for them. When we have finally solved a problem in mathematics, which has for a long time, been puzzling us, we, almost invariably find that, if we had only gone about it in the simple way, we would have gotten the answer, but instead of doing that we went about it in the long way, and find that it is not the right way. We find that the truth is simple.

So it is with every branch of learning. Truth is simple and right under our noses, if we will only recognize it and not in the far off distance. Evolution is a theory, designed to explain how it happens that things are as they are at the present time, and where they came from. There are things in it that are possible, and even things that are a little probable, but there is not one thing that has absolutely been proven to be true. It is possible, and even probable, that plants have evolved into new species of PLANT life; it is possible and even probable that animals have evolved into new species of ANIMAL life, but it is not only improbable but impossible that plants have evolved into animals, and particularly that animals have evolved into *reasoning* beings. In all the history of the world, there has never been the slightest evidence, that is acceptable to a reasoning man, of the evolution of a plant into an animal, of the evolution of an irrational animal into a rational. I will admit that it is not a contradiction of terms to say that it is possible that a plant should evolve into an animal, but it is a contradiction in terms to say that the irrational could, of itself, evolve into the rational. The rational part of man, is something that is wholly and entirely beyond the scope of matter. No reasonable man would say that in matter, there is the possibility of the conception of an abstract idea, and yet, man is able to conceive the abstract. How then could matter evolve into something that wholly transcends it? Reason is the power to conceive the abstract. Power to conceive the abstract postulates, a something that is capable of conceiving it, actually existant, and possessing it. Is this something which is capable of possessing this power found in physical matter? Certainly it is not, else, why would not brutes manifest this power? They have existed for a good deal longer than man but have never shown the least signs of reason, while man, from the date of his first being has shown decided signs of reason. If the seat of reason is to be found in matter alone, the beast ought to be more intelligent than man. Is that not reasonable?

No man of sound reason will deny that there must have been a first cause of all that exists, whatever we may call that cause. Nothing has ever been known to happen without a cause for it, and it is not instinct of human nature that it is not possible for anything to happen without some cause or other. Something caused matter to exist in the first place, and then in some way or another; it took on diversified forms. How these diversified forms came about is explained in many ways, one of them being evolution, a far-fetched, unprovable theory, and another being a perfectly simple and plausible explanation, the explanation given in the Bible, of the creation of the world by God. I should think that it would be well for lovers of science and men interested in truth, to read this explanation, ponder over it a little, compare it with the wild assumptions of evolution, and then, in all fairness, pass judgement on which of the two is the most probable, and most in accordance with the reason that we are all supposed to have.

A. M. Riordan,
Flagstaff, Arizona.

(There is evidence of evolution on every side of us. The path of man from the embryonic unicellular structure to the developed infant is one of continuous evolution. The path of man from prehistoric times to the present day is likewise one of progression.

On the other hand, in certain types of structures there is still difficulty in classifying them as either animal or plant life.

Evolution is not a bugbear. It is not as irrational a theory as many would have us believe. It does not conflict with religious teachings to any material extent as is evidenced by the fact that at Fordham University (Pre-medical Course) years ago, evolution was taught to the writer by Jesuit priests and did not cut down attendance at the church.—Editor.)

(Continued on page 724)

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In the figure at the left the card sharp is exposing a king and bending one finger over the top of the card, a natural position, but it indicates to his partner that he has a pair of kings.

More Gamblers' Tricks Exposed

By MARK MELLEN

The Man Who Fooled P. T. Barnum

ON this page are shown several more methods of cheating at the card table. This is a continuation of the international code among gamblers from the last issue, which described some of these methods. To gamblers the information is valuable in that it enables two confederates to work the trick called "playing the high hand."

Each cheater knows what his confederate has, and therefore, only the high hand plays. Let us suppose that the opener of a jack pot has bought three cards and made three jacks, while at the same time one of the confederates has two pair and the other holds three sevens. In such a case only the one holding the better hand, that is, the three sevens, will make the call. Without these signals both of them would have to call, having one pair of each, and their loss would be just twice as great when the three jacks collect the money.

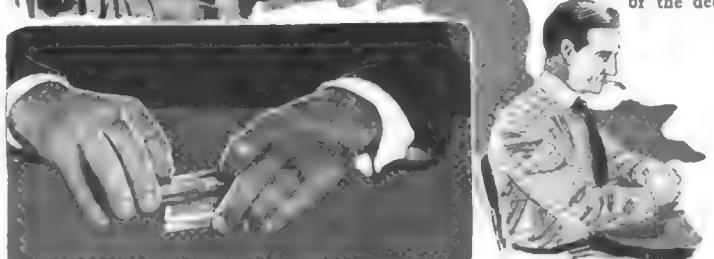
In other ways the information is useful also. One shark—Tom, we'll call him—might flash the value of his hand to his pal Jerry. "I have three sevens," he signals. Jerry takes a peek at the hand of the player next to him who is betting, and knows at once whether or not Tom has him beaten. He signals back "raise" or "drop," just as the occasion demands. Of course the other sharp does not even make the call.

Those who have been following this series of exposés had better not think that they are wise. The best "wallet filler" is the fellow who thinks he is a wise guy. The clever sharps can trim him better than anyone else.

Below the proper method of signalling to a confederate is illustrated. The five cards of the poker hand are stacked together and carelessly held in the hand. For the moment the sharper does not even glance toward his confederate to see if he got the signal. Just as the game is about to continue, he receives the "go ahead" signal from his confederate, and knows that his hand is good. The three fingers held carelessly on the top of the card indicates that the player has three cards of the type exposed, namely, the seven of spades.

In the illustration below the shark is holding two fingers over the face of the six. This indicates to his pal that he has two pair, and the card shown illustrates that the higher of the two pair is sixes. Invariably the shark stacks his five cards together, and does not show only one card as illustrated in the drawing below. This would be a dead give away. The right way to do it is illustrated at the middle right of this page.

Below the fake cut is illustrated. A good "mechanic" can run up a hand so that on the deal each player will receive the cards intended for him, but to accomplish this and disarm suspicion the man who runs up the hand must make a cut that at least looks like the real thing. He, therefore, stacks the cards to suit himself, but puts on top one card that is not requird—an extra card to be disposed of later. When through with his false shuffle, which does not shuffle the cards near the top of the deck, he grasps about twenty cards on top of the deck with his right hand, and then quickly grasps with his left hand the top card and all those under the ones that are held in the left hand (the stacked cards), just as illustrated below. Both hands are drawn apart and the top card in the left hand falls down on the other cards, while the stacked cards in the right hand are thrown on top and the deck is ready for dealing.



The "In Jog" is used to mark where cards are to be cut, so as to preserve a stack. The sharper arranges the cards in the manner he desires they should be run off when dealt. With the top twenty cards stacked he pulls the top card toward his body, draws out from the bottom about half the deck and places it on top. He shuffles thoroughly the cards that are now on top of the identifying card or In Jog and then takes hold of the In Jog or protruding card and all below it and places that bunch on top of the deck. An expert card sharp can gather up the discards and stack them at the same time. After arranging cards in desired order he divides the deck into two almost equal parts and crimps or bends the top part so that it resembles an arch or bridge, at the same time bending the lower part of the deck in the opposite direction. By a quick motion the lower half is pulled out and placed on top of the cards bent in the other direction, as shown diagonally to the right. When the cards are now submitted for a cut there will be a "break" or gap between the upper and lower halves of the deck, and an innocent person will almost invariably cut right there.

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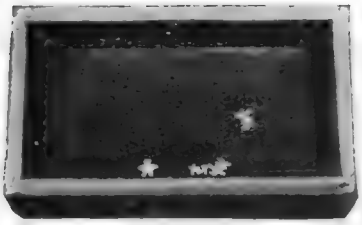
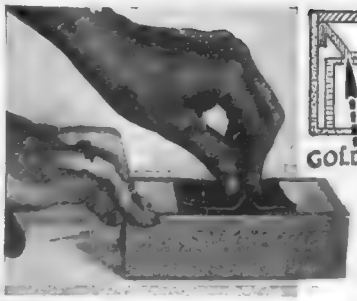
Gold Cover



The principle of the Ano Kato is involved in the first prize winning device, shown at the right and above. The box is covered with gold paper and the figures are cut from the same material. To operate, rub the glass briskly with a piece of chamois or leather. After several strokes, the paper dolls will perform a fantastic dance.



1ST PRIZE

1st Prize—$100.00 in gold:
Karl Fichtner.

2nd Prize—$75.00 in gold:
Atenodoro Herrera.

3rd Prize—$50.00 in gold:
Mrs. George B. Johnson.

4th Prize—$25.00 in gold:
Miss Marion E. Parsons.

5th Prize—$20.00 in gold:
Miss Mary H. Horn.

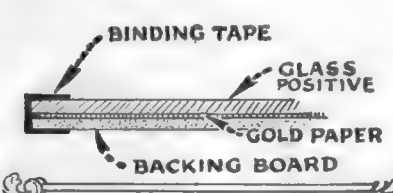
6th Prize—$20.00 in gold:
Miss Mary B. Grubb.

7th Prize—$20.00 in gold:
Earl C. Vandre.

8th Prize—$20.00 in gold:
Adolf F. Ekberg.

9th Prize—$20.00 in gold:
Thomas McCartie.

10th Prize—$20.00 in gold:
Richard Sternat.



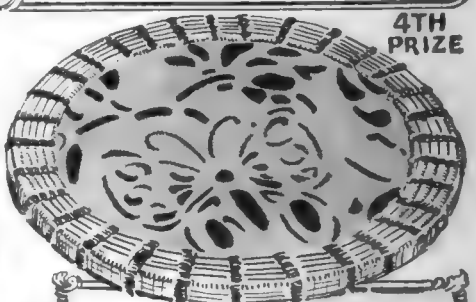
A beautiful photo transparency is prepared by making a glass positive and placing gold paper in back of it. The positive is printed from an ordinary negative, using a glass plate in place of printing paper. The construction of the transparency is shown above.

2ND PRIZE

3RD PRIZE

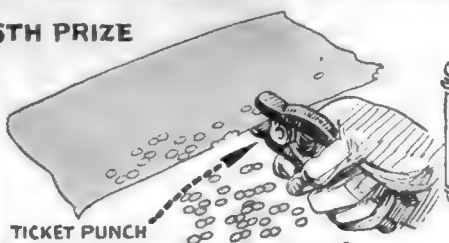
Ornamented flower pots and other like objects can be made by cutting out designs from gold paper and pasting them as shown.

4TH PRIZE

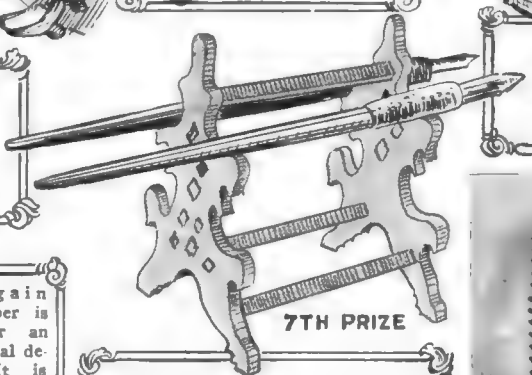


Gold paper designs may be cut out and placed in back of plain glass disks or squares. Binding the edges make a serviceable tray such as shown above.

5TH PRIZE



Small disks may be cut from gold paper with an ordinary hand punch, whereupon they can be used to decorate a candle stick in a manner shown at the right.

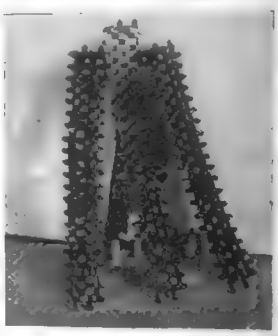


7TH PRIZE

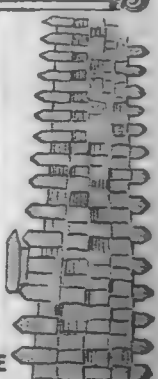
A very pleasing pen and pencil stand may be made by cutting out a design such as shown above from very thin wood and covering it with gold paper.

6TH PRIZE

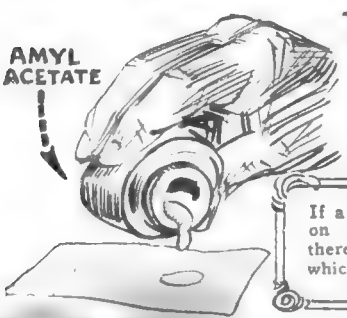
Here again gold paper is used for an ornamental design. It is cut out in the desired shapes and pasted on a metal box. The effect is pleasing and makes a useful as well as ornamental box.



8TH PRIZE

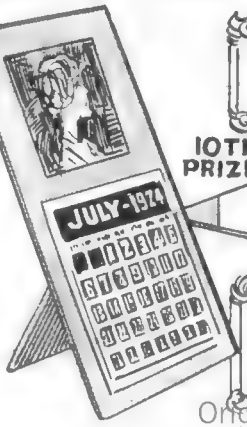


Narrow strips of gold paper may be cut out and interlaced to give a pleasing effect. Above is shown a photograph easel made in this manner.



9TH PRIZE

If a few drops of amyl acetate are placed on gold cover paper, a brush rubbed thereon will be coated with gold paint which may be used for decorating various objects.



10TH PRIZE

Corners for desk blotters may be covered with gold paper and a desk calendar may be decorated with gold paper to accompany the blotter. Such a combination gives a very pleasing effect.

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Contest Awards

11th Prize—$20.00 in gold:
E. E. Laufer.

12th Prize—$20.00 in gold:
W. T. Markowski.

13th Prize—$20.00 in gold:
No name or address on model.

14th Prize—$20.00 in gold:
A. Gruntal.

15th Prize—$20.00 in gold:
August Caesar.

16th Prize—$5.00 in gold:
Miss Kathryn Kawalick.

17th and 18th Prizes—$5.00 in gold each:
C. W. Prouty.

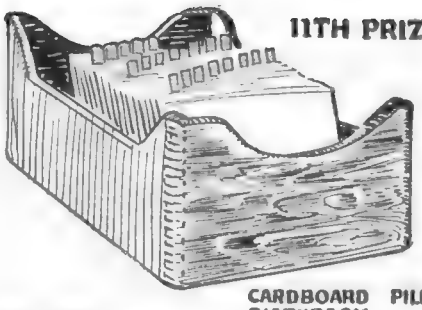
19th Prize—$5.00 in gold:
John M. Lang.

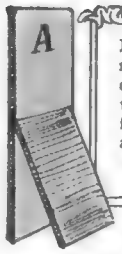
20th Prize—$5.00 in gold:
Miss Peggy Kahn.

21st Prize—$5.00 in gold:
S. S. Vidah.

DESCRIPTIONS OF DEVICES USING OUR GOLD COVER PAPER.

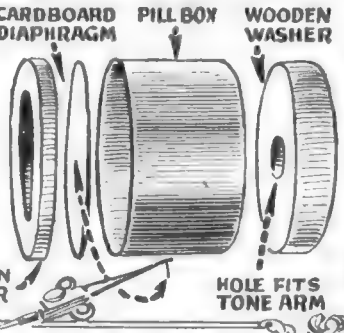
11TH PRIZE





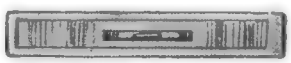
Index tabs that can be plainly read may be made from gold cover paper. Strips are cut twice as long as the tabs and folded over as shown. They are then lettered as desired and pasted to the file cards.

12TH PRIZE



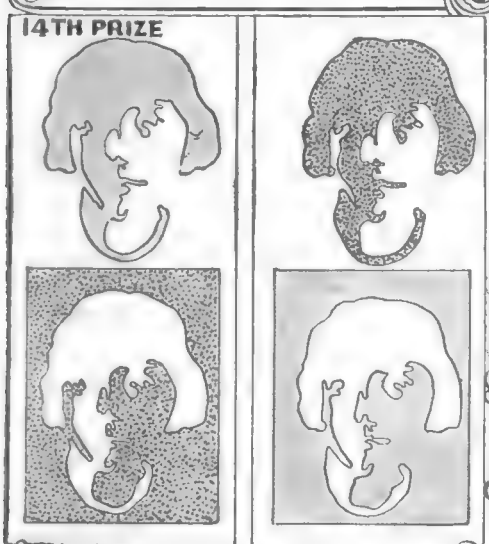
A substitute phonograph reproducer may be made as shown above and the entire device covered with gold paper. It will reproduce phonograph records well.

13TH PRIZE



A mantelpiece or desk clock may be made by cutting a form from wood as shown above and covering with gold paper. A space is provided for a watch, the stem of which will protrude as shown.

14TH PRIZE

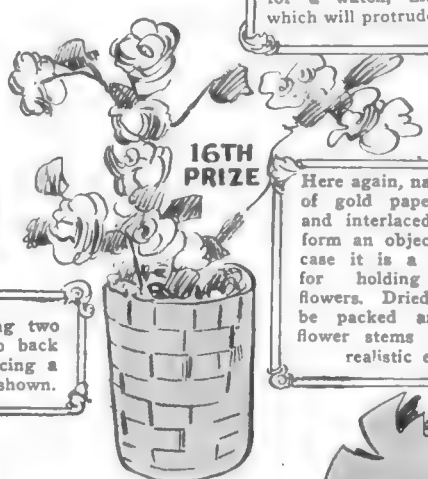


Cut a design from gold paper and mount as shown. Viewed from different angles, one of the designs will show clearly.

15TH PRIZE

Lockets may be made by inserting two disks of gold paper placed back to back between two disks of glass and placing a metal rim around the whole as shown.

16TH PRIZE



Here again, narrow strips of gold paper are cut and interlaced so as to form an object. In this case it is a flower pot for holding artificial flowers. Dried moss may be packed around the flower stems to give a realistic effect.

17TH PRIZE

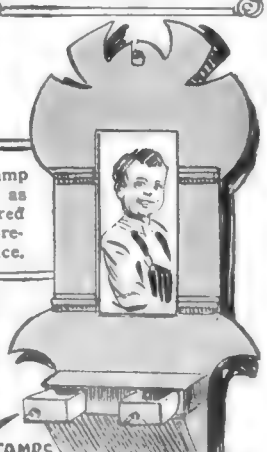
A lady's handbag is made by interlacing narrow strips of gold paper, shaping into a bag and covering with net. Decorations of gold paper may be added as taste dictates. A silk cord is used as a handle.

18TH PRIZE

A pair of book ends may be made by making up a plaster cast such as shown above and to the left and placing bits of gold paper and pebbles in the plaster.

19TH PRIZE

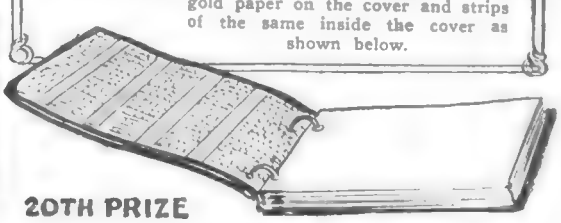
A photograph frame and stamp receptacle may be made as shown at the right and covered with gold paper. It will present a very pleasing appearance.



21ST PRIZE

A very pretty puzzle may be made by covering a letter or other figure such as shown at the left with gold paper and cutting it with a scroll saw.

Loose-leaf notebooks can be made to present a most pleasing appearance by pasting a design cut from gold paper on the cover and strips of the same inside the cover as shown below.



20TH PRIZE

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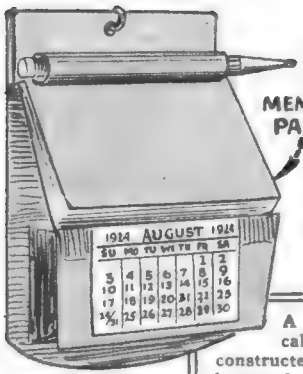
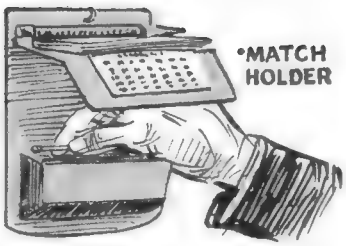
Honorable Mentions in Gold Cover Contest

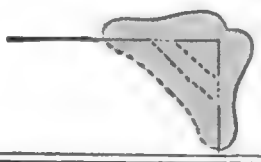




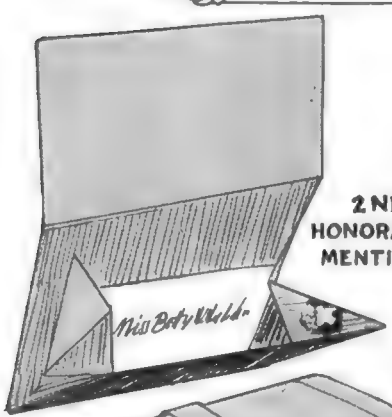
1ST HONORABLE MENTION

A combination memorandum pad, calendar and match holder may be constructed from cardboard in the form illustrated above and covered with gold paper. A paper or cloth hinge may be placed so that the cover can be lifted readily, allowing access to the matches.

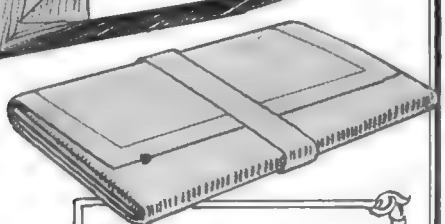
3RD HONORABLE MENTION



Very effective indeed are "art corners" used for mounting photographs in an album when they are cut from the gold paper from our cover. Directly above is shown a page of an album using these corners, while at the left is shown a detail view of one of the corners. The slits for the photograph should be cut with a razor blade.

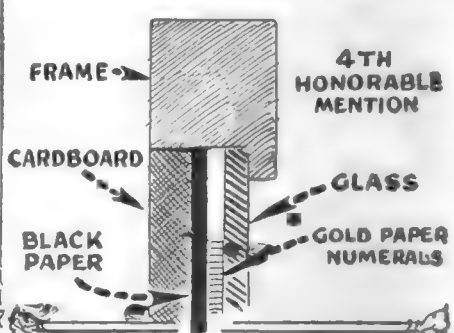


2ND HONORABLE MENTION



Heavy paper forms the base of the small pocketbook illustrated above. The material is covered with gold paper, which improves the appearance considerably.

HARDLY had the July issue of SCIENCE AND INVENTION appeared upon the newsstands when the entries in the Gold Cover Contest started to pour into the editorial office. From then until the time of closing, hundreds of entries a day were received. The sum total of all the entries ran well into the thousands and obviously there had to be many duplications in such a mass of material. Many of those devices which made use of the gold paper from our cover were good, although not as good as the prize winners. The editors, therefore, thought that it would be only fair to all concerned to issue honorable mentions to the most deserving entries that did not win prizes. Therefore, the devices pictured on this page were decided upon. In practically every case, two or more of each device were entered. Therefore, it is of course impossible to give the name of the designer of each entry.



4TH HONORABLE MENTION

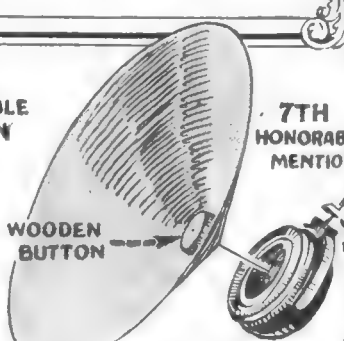
A house number which shows up very well and improves the appearance of the front door may be made as shown above, using gold paper for the numerals. The gold numerals stand out clearly against the dead black background.

5TH HONORABLE MENTION

Of late, candles and candlesticks have come into very wide use on mantelpieces as decorations. The ordinary candle is rather crude in appearance, but can be greatly improved by using the scheme illustrated at the left. Any type of design desired may be cut from gold paper and fastened to the candle with ordinary glue or common library paste.

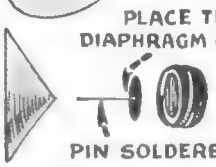
6TH HONORABLE MENTION

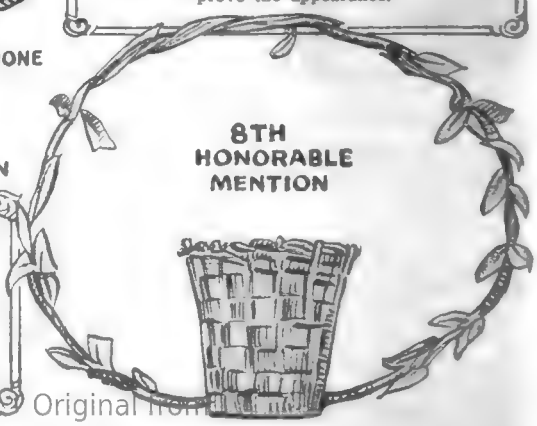
Beads and a fan made from gold paper are illustrated above. Beads are made from pennant shaped strips of the paper by rolling them up on a large pin, starting at the wide end. The bead is then shellacked.



7TH HONORABLE MENTION

A radio loud speaker may be made as illustrated at the left. The cone of cardboard is covered with gold paper to improve the appearance.





At the right is shown a decorated basket, using gold paper. The latter is pressed into service to give the leaf effect on the handle of the basket and is also used in strips for forming the body of the basket

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Magic for Everybody

By Prof. JOSEPH DUNNINGER

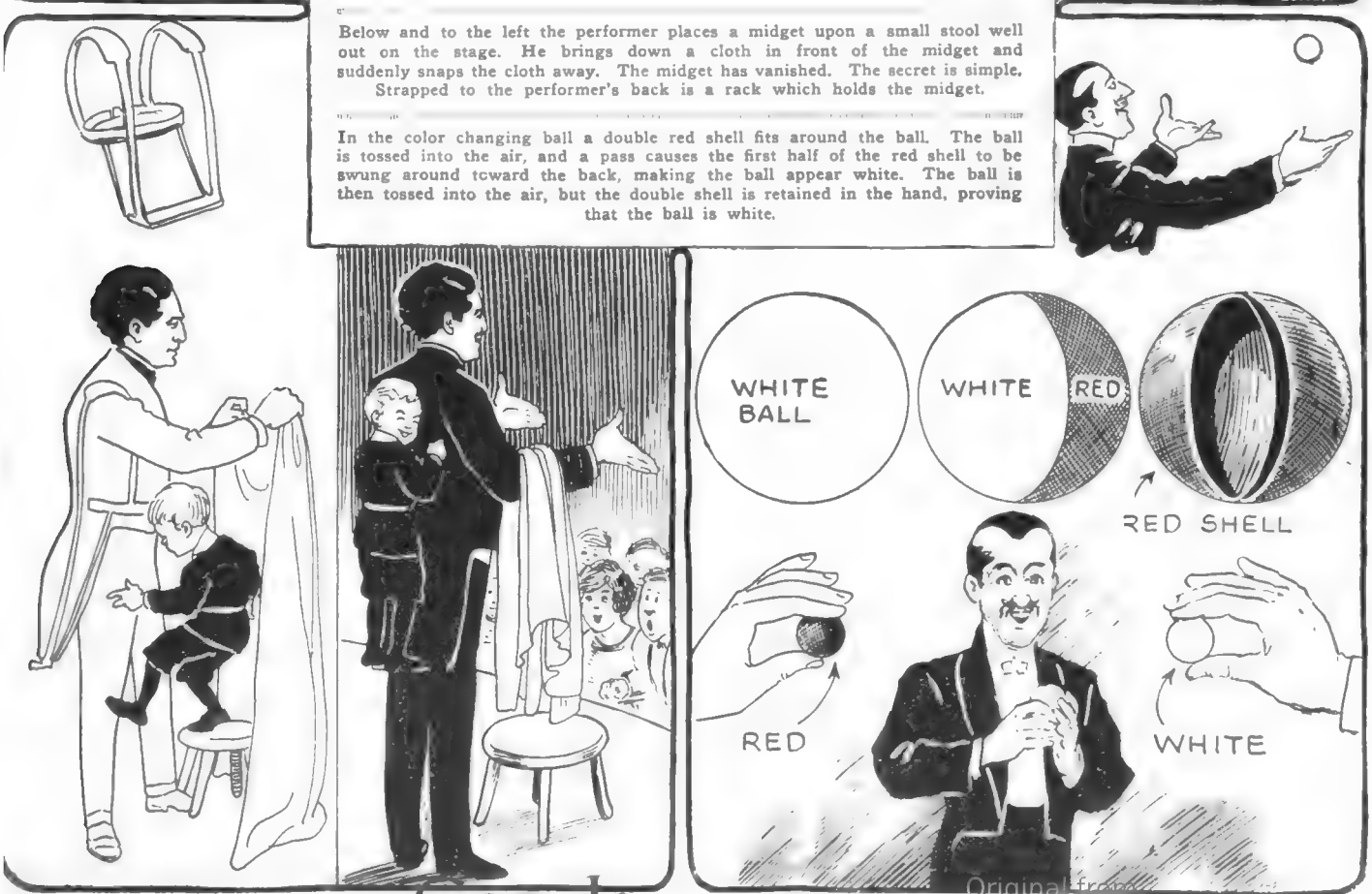
NO. 20 OF A SERIES

A fish bowl is seen to be alive with gold fish. The performer seizes his gun and fires point-blank at the fish. Instantly they vanish. The bowl is specially constructed, and the fish are enclosed in a hair net. An assistant off stage pulls the string, which draws the fish down into the bottom of the bowl.

The performer comes forth, closed opera hat in hand. The hat is opened and the hand of the performer dives down into it and a rabbit is withdrawn from the inside. The accordion silk cloth closing an aperture in the back of the hat folds with the hat. The performer's hand passes into the hat through the opening and to a pocket inside the coat.

Below and to the left the performer places a midget upon a small stool well out on the stage. He brings down a cloth in front of the midget and suddenly snaps the cloth away. The midget has vanished. The secret is simple. Strapped to the performer's back is a rack which holds the midget.

In the color changing ball a double red shell fits around the ball. The ball is tossed into the air, and a pass causes the first half of the red shell to be swung around toward the back, making the ball appear white. The ball is then tossed into the air, but the double shell is retained in the hand, proving that the ball is white.



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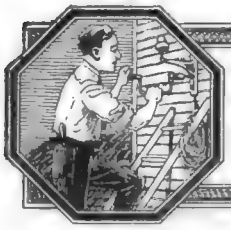
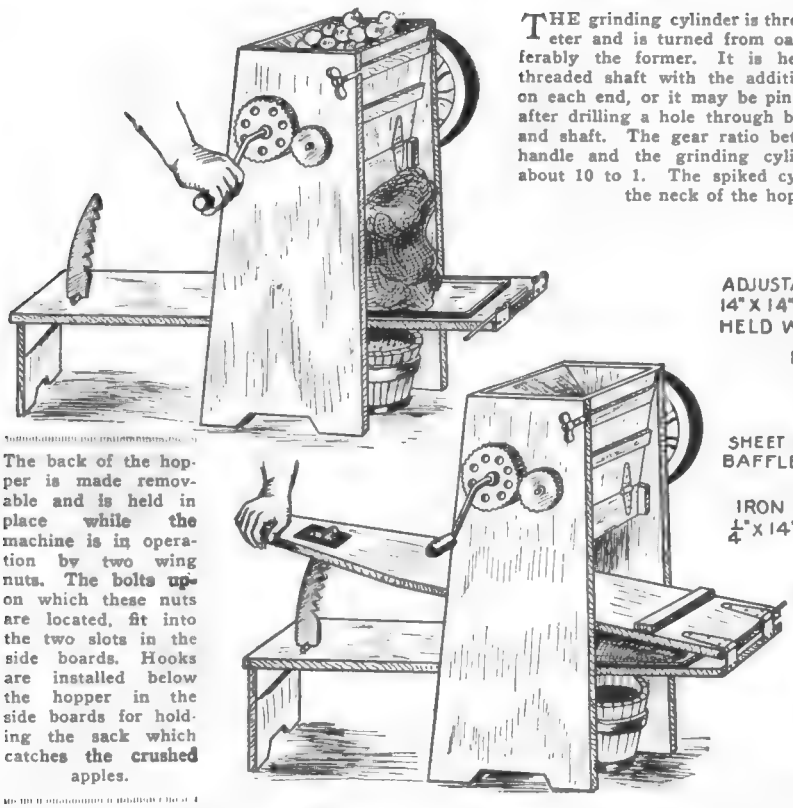


THE CONSTRUCTOR

Building a Cider Mill

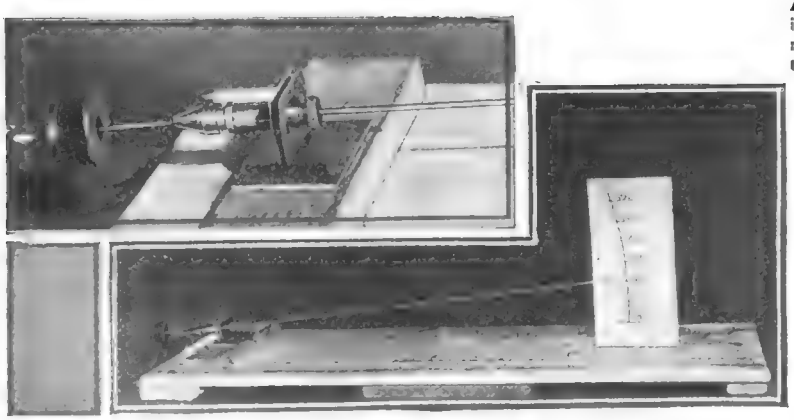


The back of the hopper is made removable and is held in place while the machine is in operation by two wing nuts. The bolts upon which these nuts are located, fit into the two slots in the side boards. Hooks are installed below the hopper in the side boards for holding the sack which catches the crushed apples.

THE grinding cylinder is three inches in diameter and is turned from oak or beech, preferably the former. It is held on either a threaded shaft with the addition of two nuts on each end, or it may be pinned to the shaft after drilling a hole through both the cylinder and shaft. The gear ratio between the crank handle and the grinding cylinder should be about 10 to 1. The spiked cylinder is put in the neck of the hopper.

An easily made cider mill pictured in the above illustrations, has a capacity of two barrels of cider per day. The shafting gears, bearings and fly wheel, are taken from discarded machinery, and the dimensions of the mill will depend upon their selection. The bottom of the press, the lever and the sideboards, should be made preferably of oak. The grinding cylinder is made of wood, into which headless spikes are driven. The lever which presses the juice from the pomace, is mounted on removable hinges. The entire weight of a man exerted at the distant end, will be sufficient to press the juice from this pomace, which is caught as it comes out of the hopper in a sack. The iron ratchet is used to relieve the pressure. —Tud Garber

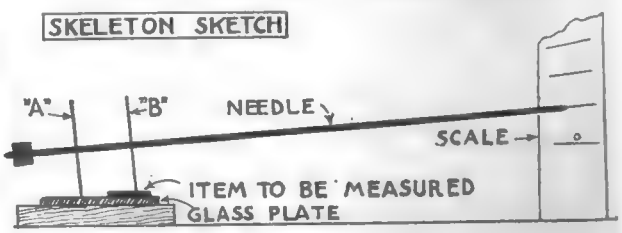
Sensitive Micrometer



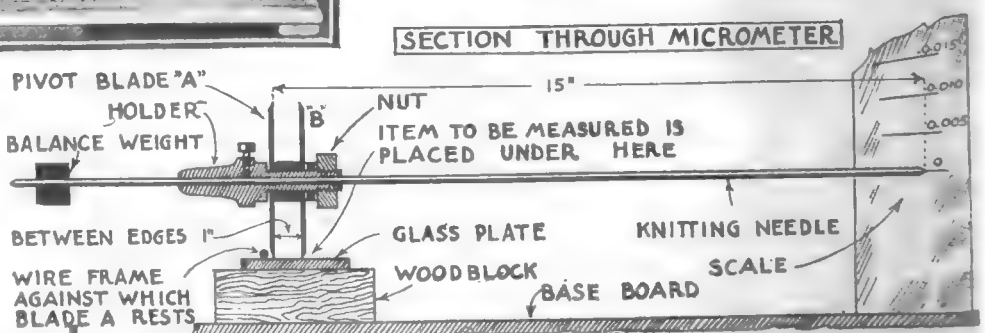
Two safety razor blades, A and B, form a most effective micrometer. One-tenth inch is allowed between the edges of the blades and the whole is mounted on a baseboard with a suitable scale. The blades rest upon a glass plate, which is in turn fixed atop a small wooden block. The wire frame is placed around the glass plate and the blades. If the needle is 15" long, magnification will be 1500 times. The piece to be measured is placed under the second or measure blade, B, as shown. —C. A. Oldroyd.

A balance weight must be added to the after end of the pointer in order to counterbalance the weight of the long end of the needle. To graduate the instrument, it is best to use shims or thin wires of known thicknesses to make the primary divisions. Secondary notations may be interpolated.

SKELETON SKETCH



SECTION THROUGH MICROMETER



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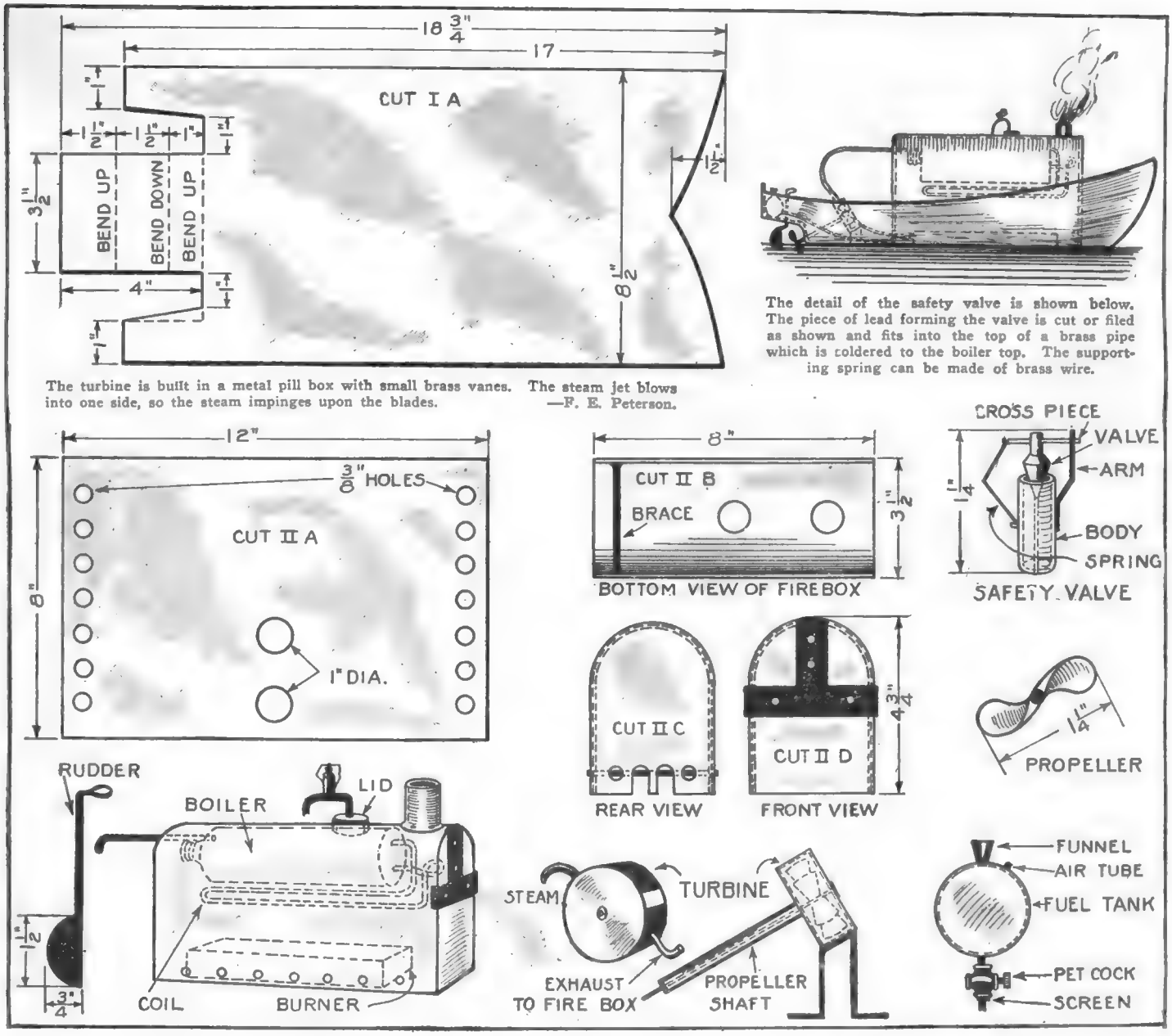
Steam Propelled Model Boat

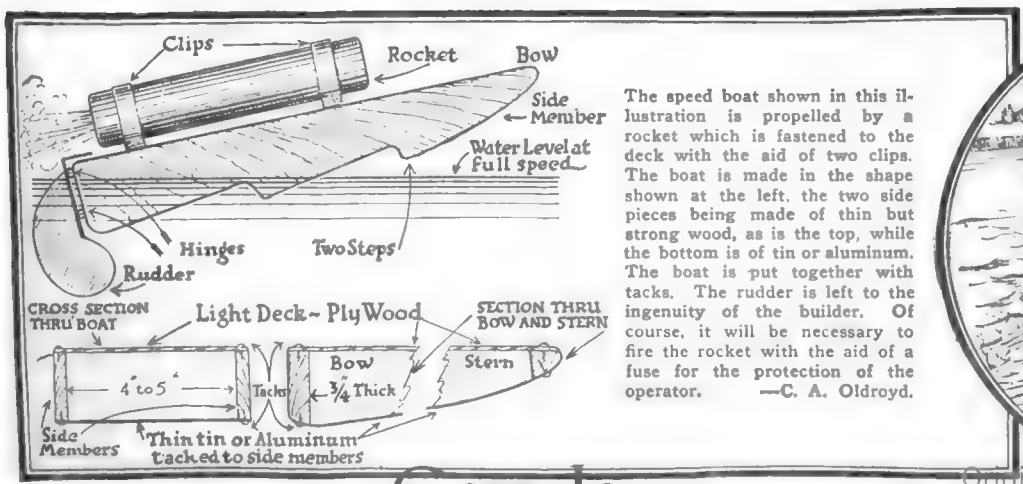


The turbine is built in a metal pill box with small brass vanes. The steam jet blows into one side, so the steam impinges upon the blades. —F. E. Peterson.

The detail of the safety valve is shown below. The piece of lead forming the valve is cut or filed as shown and fits into the top of a brass pipe which is soldered to the boiler top. The supporting spring can be made of brass wire.

The turbine propelled boat constructed entirely of metal shown in the above illustration, is extremely simple to build and the materials may be obtained from scraps found about the home. Cut IA is the hull and is bent as shown, the joints being soldered. The forward hole takes the smoke stack and the one just behind it the boiler lid. The burner is a sardine box filled with wicking. The fuel tank is aft.

Rocket Propelled Speed Boat



The speed boat shown in this illustration is propelled by a rocket which is fastened to the deck with the aid of two clips. The boat is made in the shape shown at the left, the two side pieces being made of thin but strong wood, as is the top, while the bottom is of tin or aluminum. The boat is put together with tacks. The rudder is left to the ingenuity of the builder. Of course, it will be necessary to fire the rocket with the aid of a fuse for the protection of the operator. —C. A. Oldroyd.

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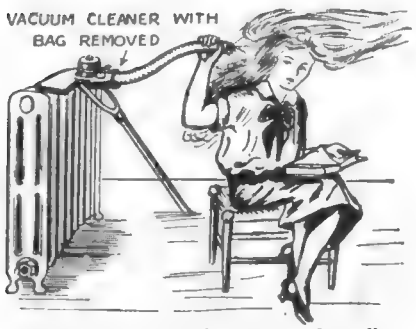
HOW-TO-MAKE-IT

This department will award the following monthly prizes: First prize, $15.00; second prize, $10.00; third prize, $5.00.
The purpose of this department is to stimulate experimenters toward accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department a monthly series of prizes will be awarded. For the best idea submitted a prize of $15.00 is awarded; for the second best idea a $10.00 prize, and for the third best a prize of $5.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

Hair Dryer

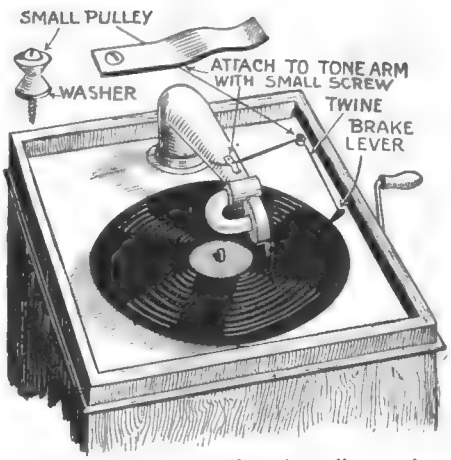
FIRST PRIZE $15.



By placing a vacuum cleaner atop the radiator as shown above, the hot air pulled through the cleaner and ejected at the exhaust will be found very effective in drying the hair.
—F. L. Kelsey.

Record Stop

SECOND PRIZE $10



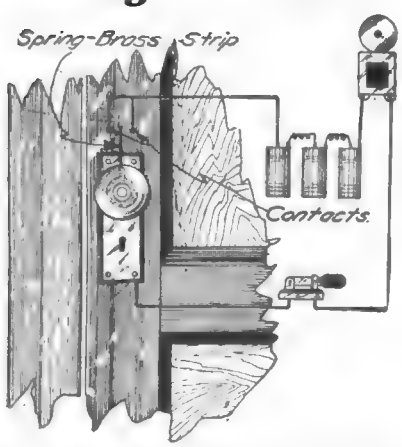
By attaching the small spring clip to the tone arm of a victrola installing a small pulley, and running a thread from the brake lever to the clip, an effective stop is made.
—W. T. Markowiski.

Fine Writing

THIRD PRIZE $5

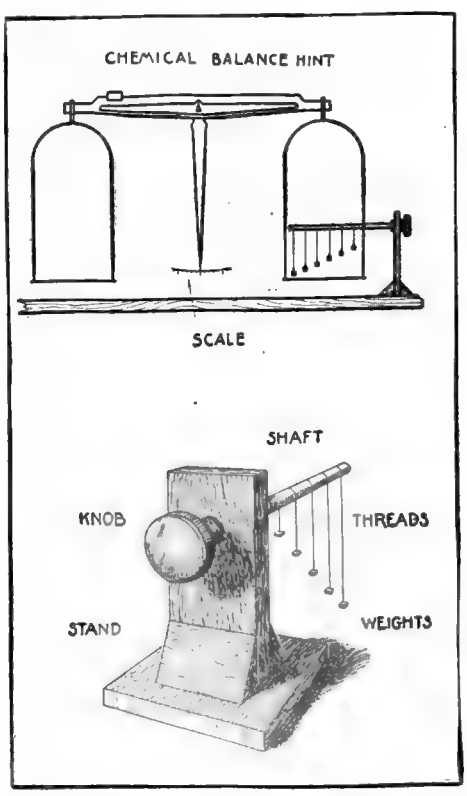
By attaching a magnifying glass to a fountain pen, as shown, suprisingly small script can be written by anyone. Try it. —Jacob Schmidt.

Burglar Alarm



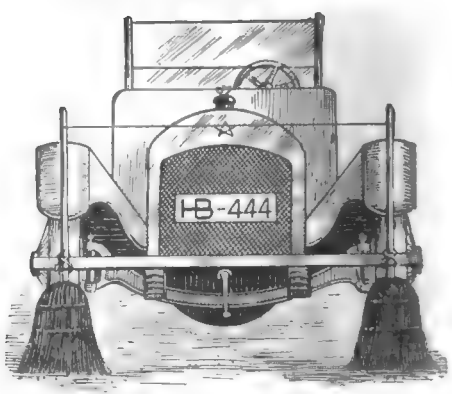
Two nail contacts, a bit of spring brass and some battery wire attached to the door as shown in the above illustration, form an effective burglar alarm.

Balance Kink



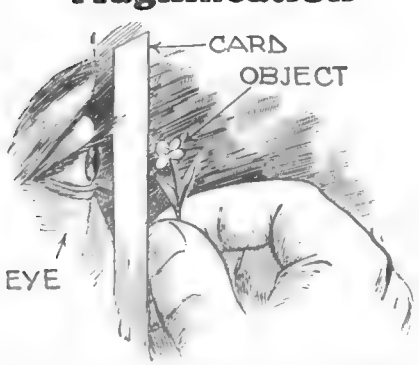
Where much weighing is to be done, the arrangement of attaching the weights by fine silk threads to a shaft and knob which holds them over the balance pan, so that they may be dropped on the pan consecutively, is very good. Very fine thread must be used so that its weight will have no effect on the balance.
—Esten Moen.

Save Punctures



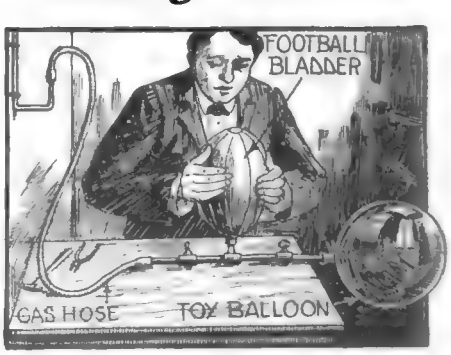
If the street sweepers go on strike, try the above idea for preventing punctures. It may come in handy around the garage driveway if there are bits of glass or tacks about.
—F. Fornos.

Magnification



When afield and needing a small magnifying glass, punch a small hole through a bit of cardboard, and observe the image close to the eye. Greater magnification can be had in this manner than with the ordinary small lens. Focusing must be made in a very strong

Filling Balloons



For filling toy balloons with buoyant gas allow the gas to pass into the football bladder, then close the first cock and open the second, and force the gas into the balloon. This system allows sufficient pressure to be placed on the gas to force it into the balloon, which is not possible, using only the pressure of the gas mains.
—W. L. Todd.

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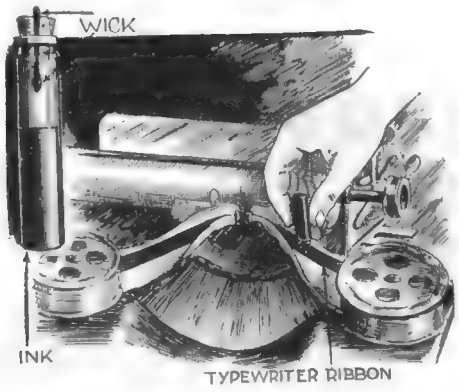
WRINKLES
RECIPES & FORMULAS

Edited by S. GERNSBACK

Ribbon Inker

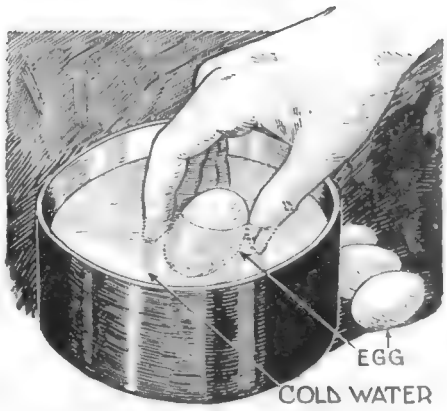


Restore typewriter ribbon by splitting the cork of a vial and inserting a wick of canton flannel, making a self-feeding brush, and painting the ink on the ribbon. Ink is made as follows: Glycerine 4 ounces, soap shavings 1 ounce, water 12 ounces, grain alcohol 20 ounces, aniline 1 grain. Mix water and glycerine over fire and dissolve soap. Dissolve color in alcohol and mix solutions. —K. B. Murray.

Indicator

A piece of solid steel stock bolted to the bottom of a baking powder can upon which the cover has been soldered, used as shown in the illustration, makes a good detector of knocks in engines. —J. F. Wilhelm.

Boiling Eggs

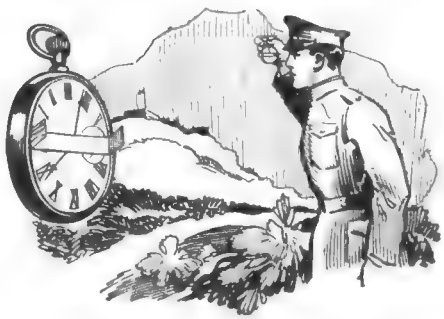


If eggs are placed in cold water before boiling as shown, the shells will not crack. —Richard Fielder.

Orange Fireworks

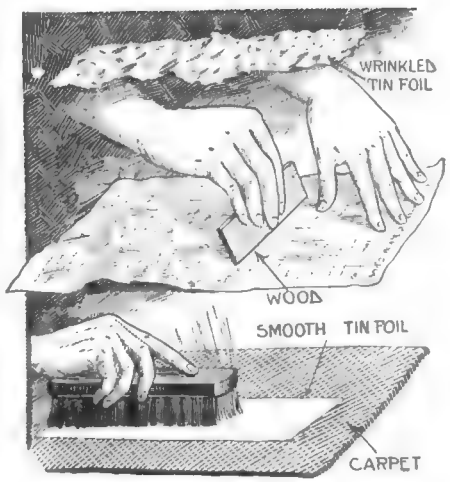
If the juice from an orange peel is thrown into a candle flame, fireworks results. —Dr. Albert Neuburger.

Watch Compass



If a watch is held suspended by its chain, and a small strip of paper is bent as shown and pasted so that the upper edge is in line from twelve to six, an extremely handy level results. The paper will indicate true horizontal. —Ben Zyl.

Embossing Foil

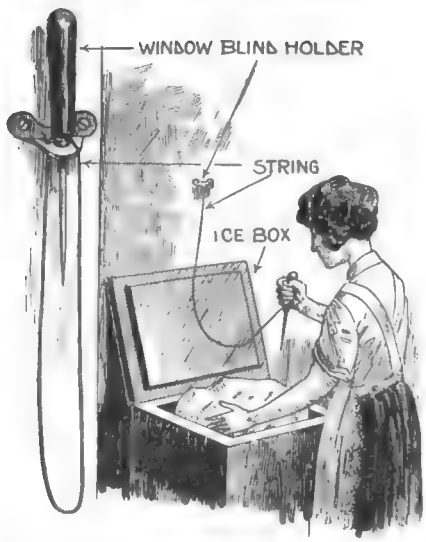


If tin foil is first smoothed with the use of a small board, then rubbed by a brush as it rests on the carpet, it may be embossed beautifully. —James E. Noble.

Glacier Mill

If a layer of clay is placed in the bottom of a tumbler, a couple of marbles on the clay, and a stream of water played on the clay, the marbles will mill a glacier pot hole. —Dr. A. Neuburger.

Ice Pick Holder



A shade holder and string, as shown in the illustration, will keep the ice pick in place. —Herbert E. Morris, Reporter No. 9303.

Celluloid Ball

Kinks may be taken out of celluloid balls by heating the depressed portion slightly with a flame, care being taken not to burn the ball. —Arthur Johnson, Reporter No. 5877.

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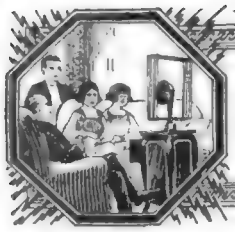
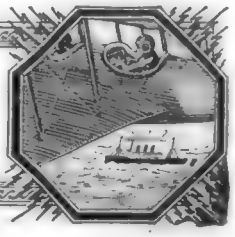


RADIO



Retransmission From Airplane

The above photo shows Lieut. Franklin L. Rash, of the U. S. Army Air Service, with the compact radiophone transmitter employed in speaking from his plane to his colleagues on the ground.

The messages from the 155-watt transmitter on the plane were picked up and amplified. The voice-currents were then passed through a microphone and carried by land line to the broadcasting station, where they were sent out on another wave-length. Thus thousands of people were able to listen to the conversation between the rapidly moving plane and the land station. Lieut. Rash witnessed the arrival of the round-the-world fliers and gave a detailed description of the approach of the Magellans of the air.

A cone type loud speaker made of pleated paper is one of the latest types of reproducers guaranteed to reproduce all overtones without causing distortion, or in any other way altering the true rhythmic qualities of the music.

Phonographs, book cases, library tables and other household utilities have been used in modified forms in conjunction with the operation of radio receiving instruments. It remained, however, for the Signal Corps of the War Department to make use of a desk lamp as a loud speaker and yet retain the true purpose of this electric lighting unit.—S. R. Winters.

And now the radio motor. C. Francis Jenkins, famous inventor, is shown above with his newly invented motor. When attached in the place of a loud speaker it revolves at high speed, producing an appreciable amount of power. The radio motor represents a step in transmitting radio power.

WE want descriptions of new radio ideas which you have worked out in practice. Take photographs of the important parts and make pencil or pen and ink sketches of the hook-ups or mechanical details, et cetera. We are particularly desirous of obtaining new hook-ups and descriptions of single tube, reflex and other types which have proven satisfactory.

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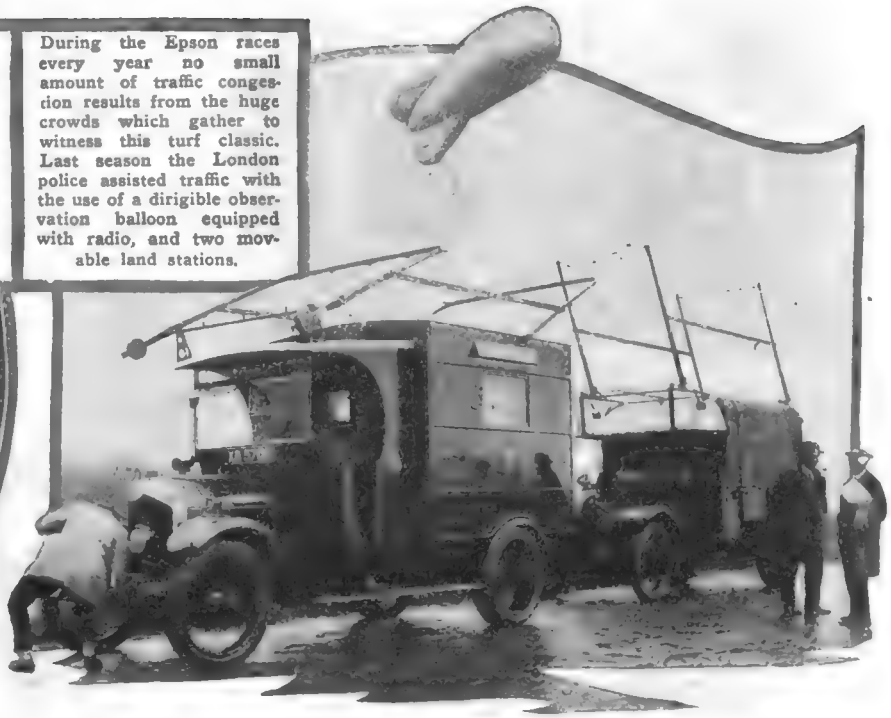
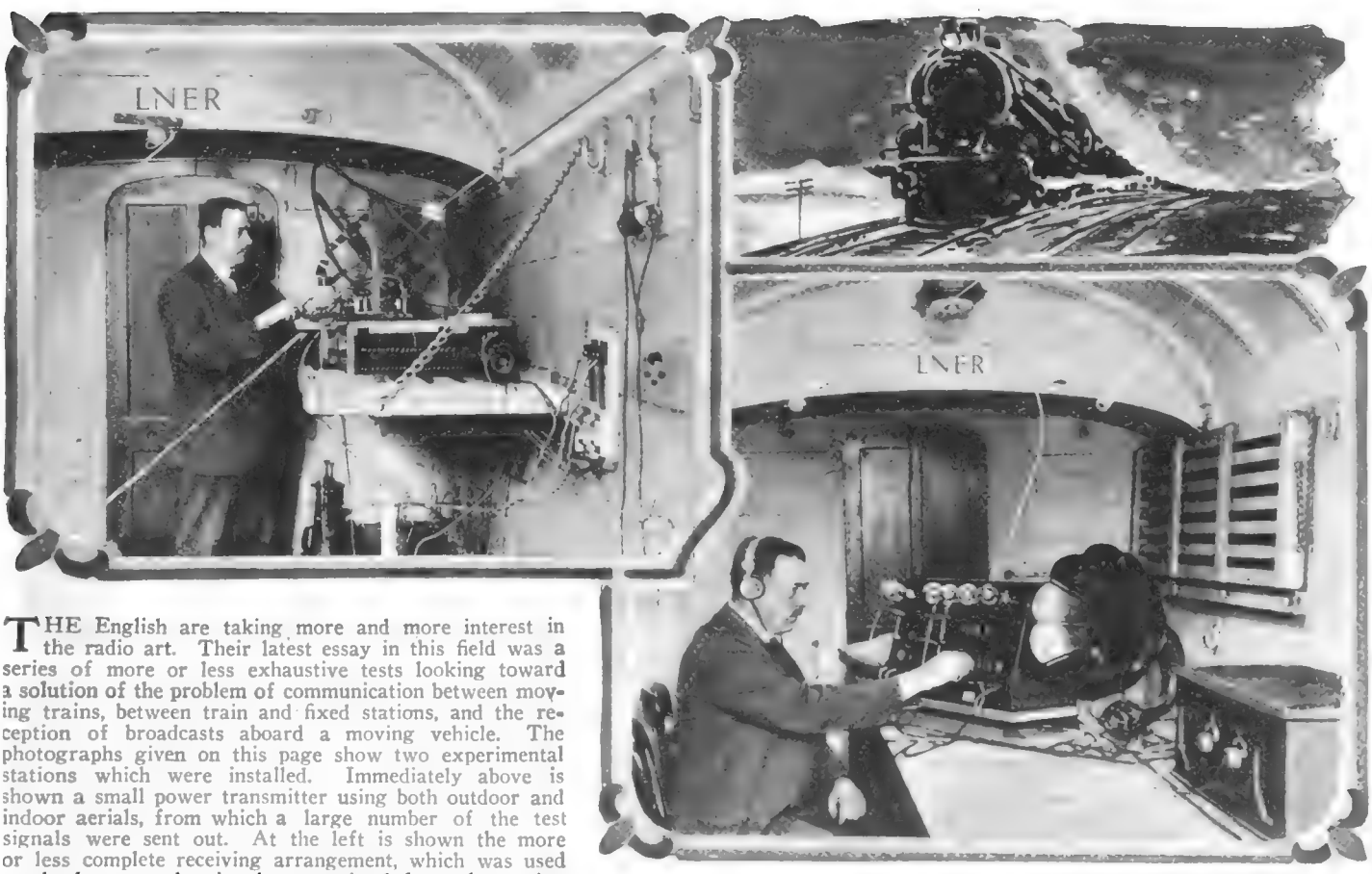
Radio in Peculiar Rôles

Competition is so keen among the New York bootblacks that a special ingenuity must be shown for anyone to obtain an extra measure of trade. Joseph Camarato seems to be one of the brightest of the lot, for he conceived the idea of installing a small one tube outfit in his blacking box to entertain clients.

During the Epson races every year no small amount of traffic congestion results from the huge crowds which gather to witness this turf classic. Last season the London police assisted traffic with the use of a dirigible observation balloon equipped with radio, and two movable land stations.



In the Train Radio



THE English are taking more and more interest in the radio art. Their latest essay in this field was a series of more or less exhaustive tests looking toward a solution of the problem of communication between moving trains, between train and fixed stations, and the reception of broadcasts aboard a moving vehicle. The photographs given on this page show two experimental stations which were installed. Immediately above is shown a small power transmitter using both outdoor and indoor aerials, from which a large number of the test signals were sent out. At the left is shown the more or less complete receiving arrangement, which was used to check up on the signals transmitted from the station shown above, while the car in which it was installed were being pulled behind an express train. Very complete data was gathered and a large number of possible conditions covered in these tests. The station making the test was assigned the call letters 2XX. It was hoped by the experimenters that some positive idea and arrangement could be figured out through which communication to and from moving trains might be arranged for commercial success. Much work will be done in connection with a new high-powered transmitter erected by the British Broadcasting company at the Marconi plant near London. Tests are to be carried on during the entire winter. Excellent results are expected.

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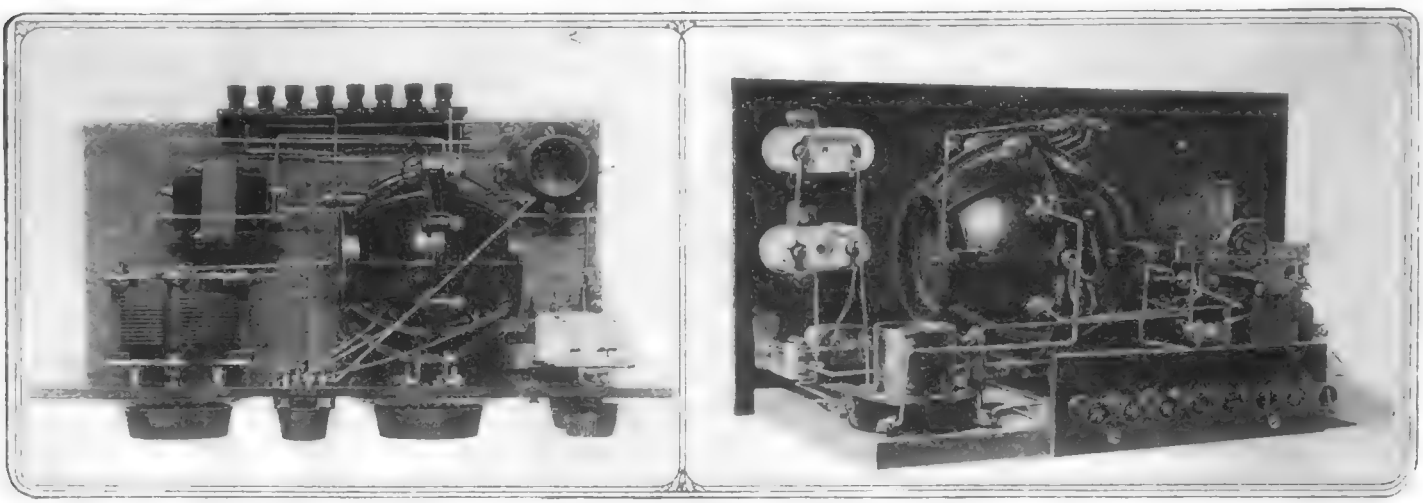
A Practical Solodyne Receiver

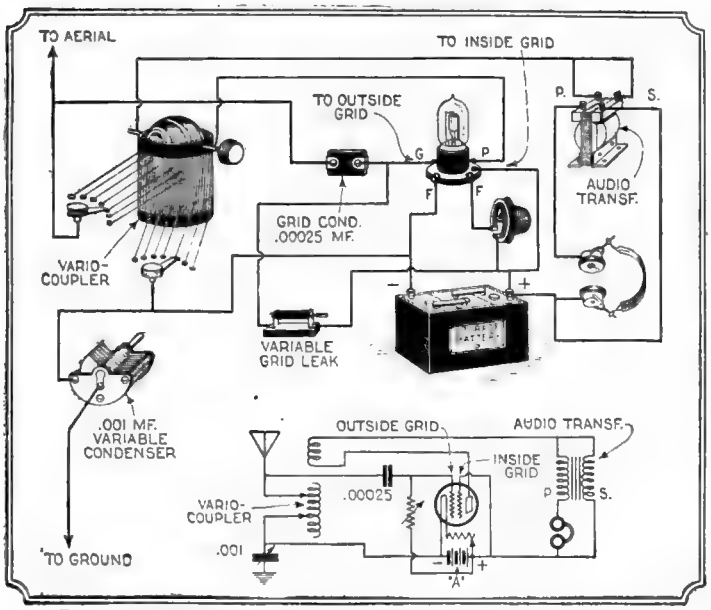
Now that the elimination of the expensive "B" batteries is an accomplished fact, we are pleased to give herewith a complete description of a single tube Solodyne set. Last month the theory of the Solodyne circuit was described in full. Its main feature was presented in its reproduction of music and speech with a clarity equalled only by the crystal. Then again, the burning out of a tube due to an excessive high voltage becomes an impossibility since the "A" battery alone cannot do so. Due to the elimination of all internal noises, the reception of distant stations becomes relatively greater. The real success of the Solodyne lies in the use of a new type, four element tube.

THE photo on the immediate left shows the front view of the one tube Solodyne set, which comprises a standard variocoupler, a 43-plate condenser, a variable grid leak, a 30-ohm rheostat, a socket, an A.F. transformer, together with the necessary binding posts and contact points. The exact layout is clearly evident from the two photos below. It should be remembered that only the best of materials and instruments will give satisfactory results.

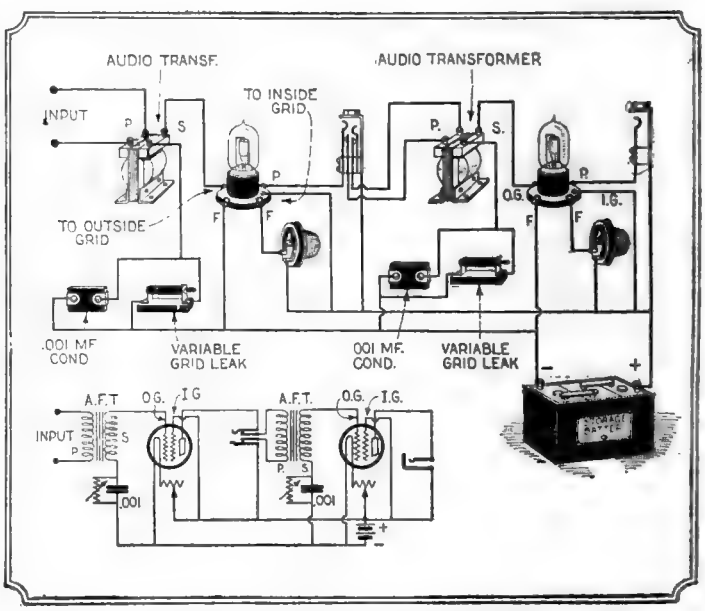


The above top view illustrates the arrangement of the various parts employed. The variocoupler has 60 turns on its primary, which is tapped at every 15 turns. In addition a .001 variable condenser tunes the primary circuit to resonance with the incoming wave.

All the binding posts are conveniently racked on a bakelite strip attached to the baseboard. The wiring is direct as much as possible and is of heavy bus wire. A 4 to 1 ratio transformer is used in the capacity of an R.F. choke and affords greater amplification.



The wiring diagram of the set shows the new four element tube and the connections to it. Two concentric grids are contained within; by carefully adjusting the variable grid leak, maximum amplification can be obtained. This circuit is regenerative.



To increase the volume, a two-stage amplifier using Solodyne tubes is added in the same manner as the ordinary amplifier unit. The outstanding feature is the omission of the "B" batteries, thus affording tonal quality that cannot be obtained even with the resistance coupled amplifier.

THE complete receiver comprised of detector, and two stage audio frequency amplifier operating on the Solodyne principle, is clearly depicted in the above two diagrams. The input to the amplifier unit is connected to the detector circuit in place of the phones, while the latter are plugged in on the third tube. The volume that is realized by this combination is easily equal to that [illegible] from an ordinary detector and one stage amplifier, using "B" batteries. The special arrangement used in the amplifier circuit is the introduction of a grid condenser of high capacity shunted across a variable leak. Standard audio frequency transformers of 4 to 1 ratio are employed. The amplifier is mounted on a panel 10″ x 7″. It must be remembered that this is a great stride in the perfection of the reproduction of clear programs and as such, extreme volume is obviously not a prime consideration.

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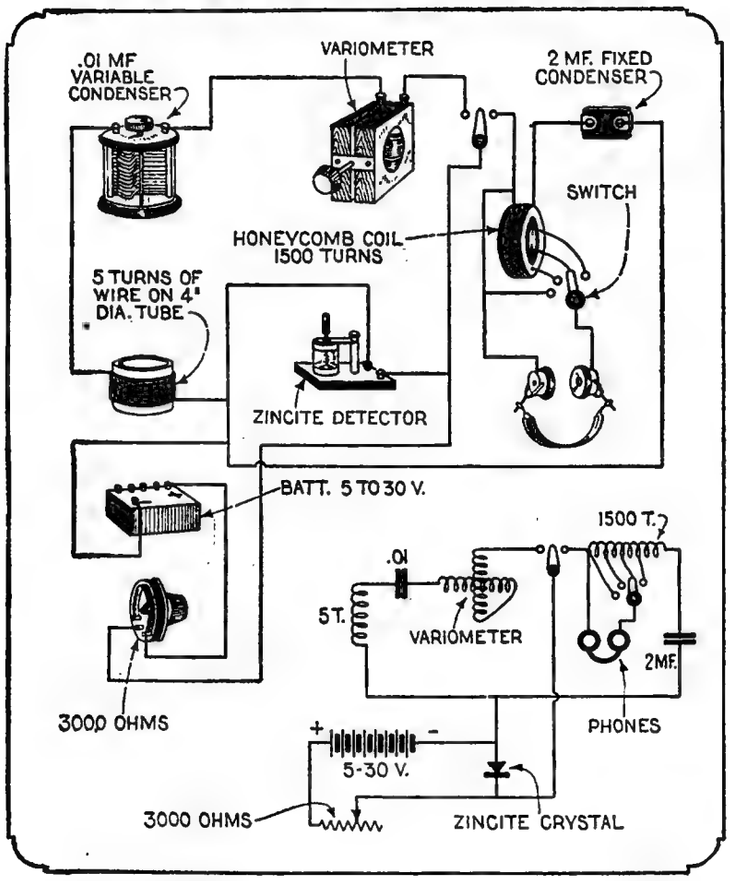
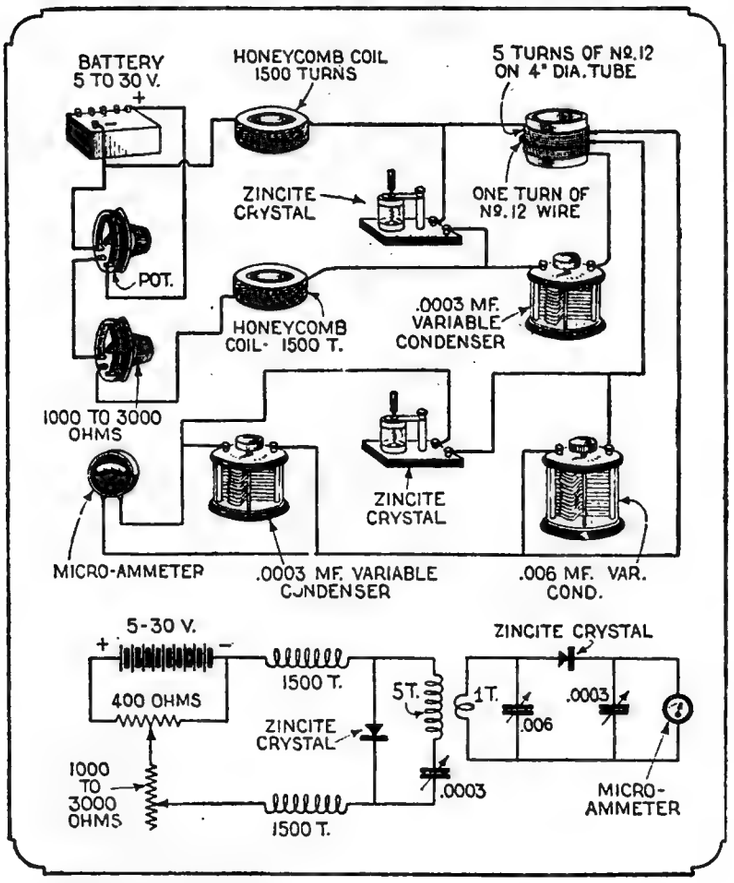
Experimental Crystodyne Circuits

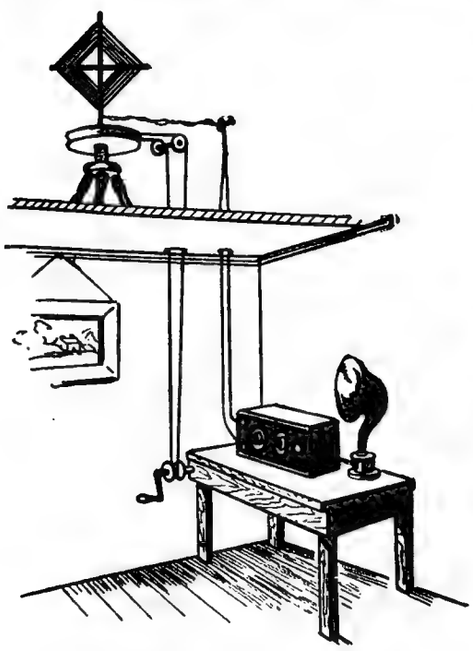


The diagram shows a practical combination of both audio and radio frequency oscillator using a zincite crystal as the generator. A five turn coil is coupled with any non-regenerative receiving circuit with the crystal oscillating at radio frequency. Thus the reception of undamped waves can be realized. The sustained oscillations are of a frequency entirely dependent upon the constants of the circuits. By careful adjustment of the high resistance, it is possible to create a maximum intensity of signals.



The current delivered by the oscillating crystal is so exceedingly small that it requires the use of a milliammeter to measure it. The zincite crystal is placed in an audio oscillator circuit and is coupled to the micrometer by means of a small transformer, whose description is pictured above. The meter itself is placed in a tuned oscillatory circuit. The Crystodyne affords much opportunity for experimentation, as the subject, heretofore thought impossible, lends itself readily for various adaptations.

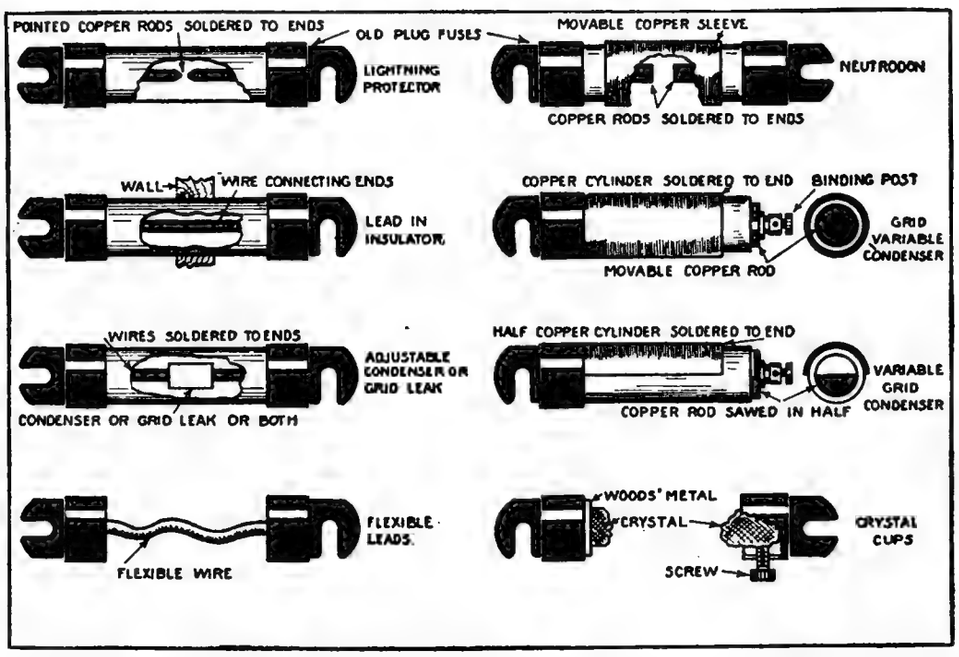
Loop Mounting



A common piano stool proves handy for the mounting of a loop antenna. The antenna is fastened to the top of the stool, as illustrated in the diagram above, and a piece of cord or fish line is then passed around the stool over two pulleys and then to a drum fastened near the set. By turning the crank the stool and loop are rotated.

—L. B. Robbins.

Uses for Cartridge Fuses



Cartridge fuses make useful articles. The top illustration shows a lightning protector, which is made by removing the ends of the fuse and soldering two pointed copper rods to them. When replaced the ends should be 1/16" apart. The lead-in insulator is self-explanatory. A piece of graphite put into the fuse and a slider to which a wire is soldered, produces an adjustable grid leak. Flexible leads can easily be made using the ends of the fuse as lugs. A movable copper sleeve and two short copper rods forms a neutrodon. Two types of grid condensers are illustrated above. The first has a sliding copper cylinder contained within the insulating portion of the cartridge fuse, while in the second the half cylinder revolves.

—A. Blumenfeld.

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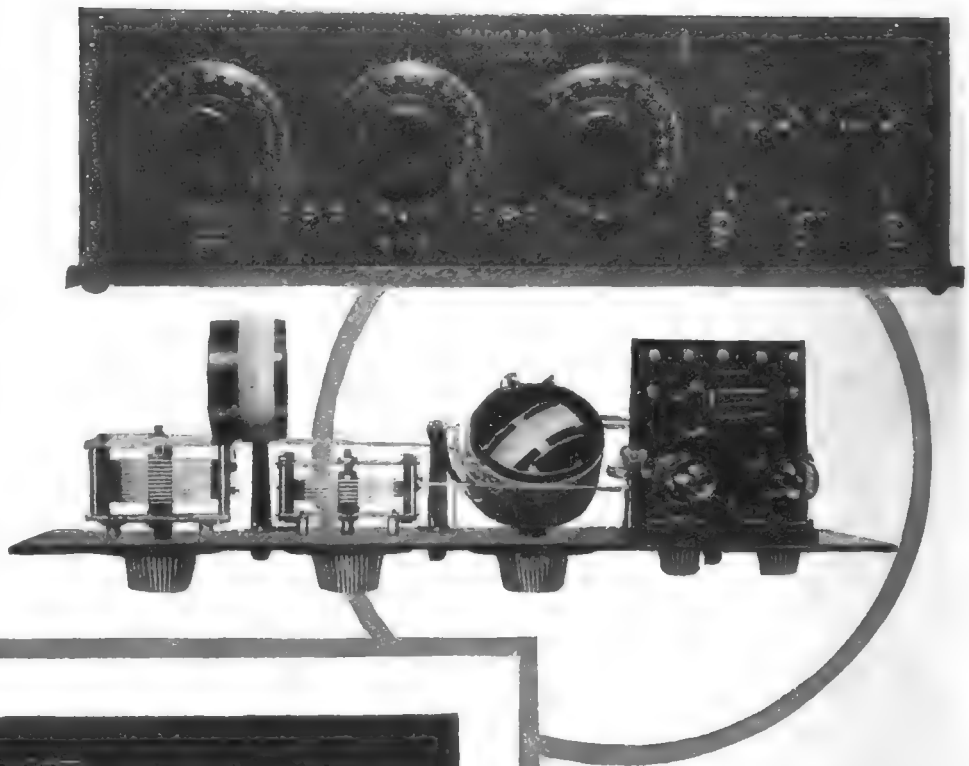
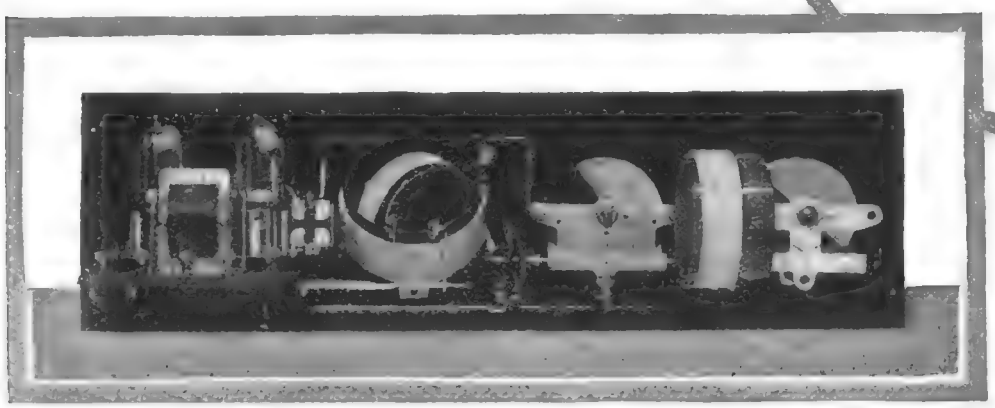
A Real Short Wave Receiver

By ALFRED R. MARCY, 2DK

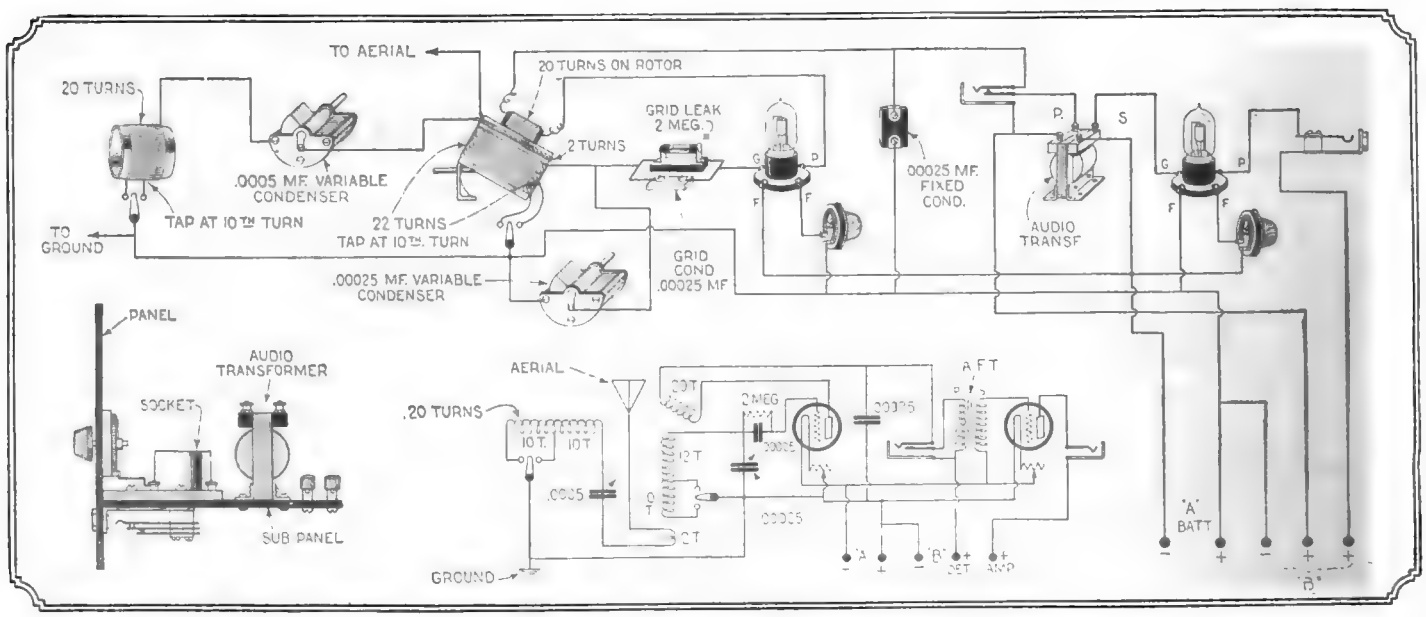
WITH the present trend in the development of the short waves, many of our powerful broadcasting stations are transmitting at these higher frequencies with very good success. WGY on 107 and KDKA on 97 meters come in with loud speaker volume on this very efficient two tube set. Among the foreign stations heard are PCII in Holland, 8AB and 8ARA in France, 2LO, 2SH, 2OD, 2KF and 5NN in England, with even ACD in Italy! Covering a range from 60 to 220 meters, the set is equipped with two small jack switches which divide the frequency range from 60 to 120 meters and from 120 to 220 meters. For reason of the employment of "low loss" parts, this circuit, which is merely a regenerative one, having one stage of audio amplification, is giving unexcelled results both in the matter of extreme selectivity and the reception of distant stations. Note the very neat construction which goes a long way in conserving the infinitesimal etheric energy collected by the antenna. All in all, the writer believes that the results obtained have more than justified the care taken, while the use of only the best material of the latest engineering design is in part also responsible.





The apparatus is so arranged as to allow of simplicity in wiring. The fact that the antenna loading coil is placed immediately between the primary and secondary tuning condensers, thus allowing not only inductive, but capacitative feed-back may, on account of the magnetic linkage between the condensers, account partially for the excellent results.

A 7"x21" bakelite panel offers the best support for the various instruments. A small sub-panel, which is attached as is clearly shown in the lower diagram, contains two sockets, the audio transformer and the necessary binding posts.



The antenna tuning system is of the shock excitation type with sufficient inductance in the circuit to make up for the desired wave-length. The loading coil consists of 20 turns of No. 18 D.C.C. wire wound on a 3¼ inch diameter bakelite tube and is connected in series with two turns of the same wire, wound on the stator of the variocoupler. The secondary winding is 22 turns of No. 14 D.C.C. wire on a 3½ inch tube and has a tap taken off at the 12th turn. The tickler is wound on the rotor, 3 inches in diameter and consists of 20 turns of No. 22 D.S.C. A 4 to 1 ratio transformer is used with either UV-199s, WD-12s or 201As. Of these, the latter tubes will give slightly greater signal intensity. Remember to do all soldering carefully and, as will be seen in the photos, the elimination of spaghetti was achieved by the well designed layout. A small jack type switch controls the "A" battery.

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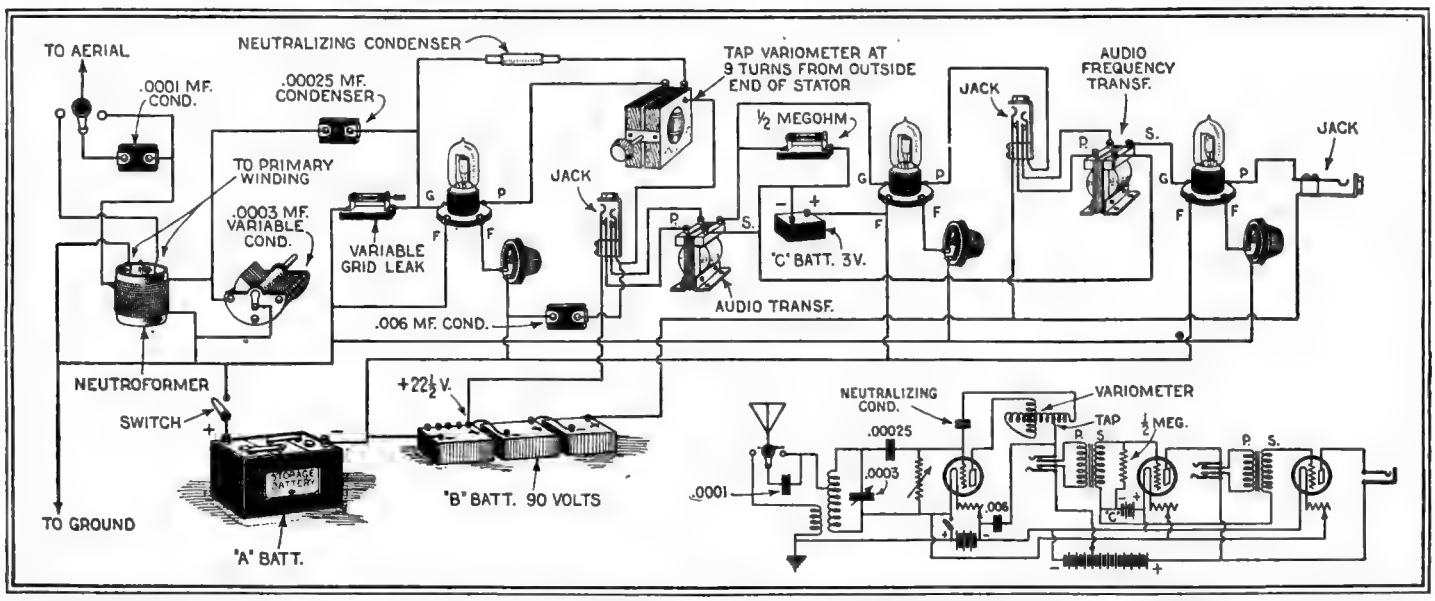
Two Control "DX" Set

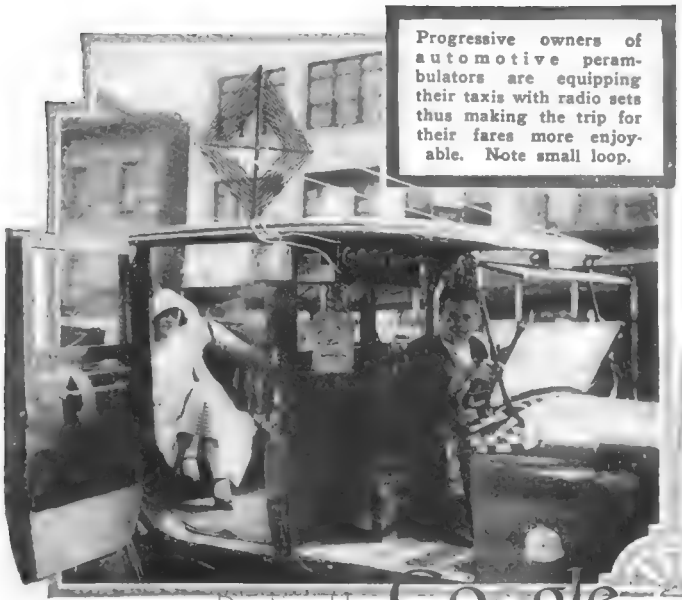
Believing that the inherent possibilities of but three tubes can do as much as eight or ten, the builder of this outfit, Sterling G. Sears of Brooklyn, N. Y., has reached his goal. The circuit employed can be changed from inductively to conductively coupled detector and two stage amplifier combining regeneration. Experiments by the builder have proved the fact that the neutroformer is very efficient as a receiving transformer.

Particular notice should be taken of the neat construction involved. All binding posts are racked on a strip of bakelite in the rear of this set, thus facilitating connections. A metal shield is used doing away with all disturbing body capacity. Reception of stations on the Pacific coast is quite frequent and is much simpler than with a multi-control set.



The variometer used is of the ordinary type but is tapped at the 9th turn from one end. Besides this, one-half megohm leak is shunted across the secondary of the first audio frequency transformer. For selectivity, this set is hard to beat, also giving very loud signals.

Taxi Has Radio



Progressive owners of automotive perambulators are equipping their taxis with radio sets thus making the trip for their fares more enjoyable. Note small loop.

Checking Sun Time

A new use for radio-checking up sun dial.

Not many people know that the government gives a wonderful service entirely free of charge, in its transmission of accurate time signals and weather reports. These time signals are accurate to a few hundredths of a second. Photo shows men checking up on Old Sol.

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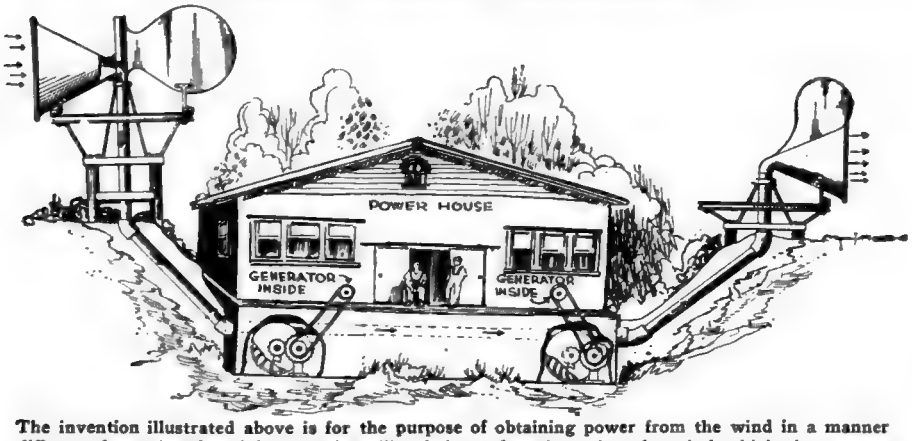
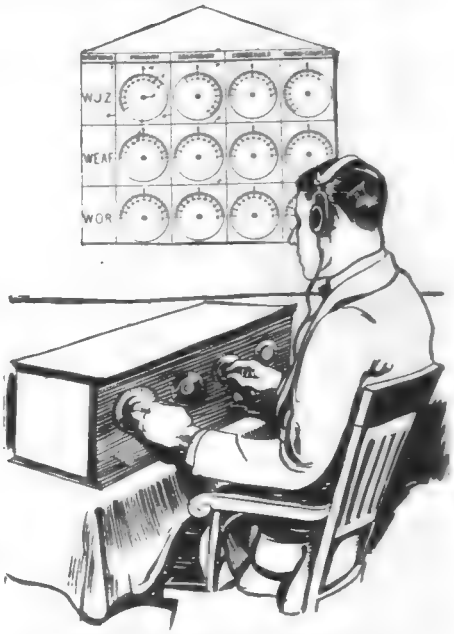
LATEST PATENTS

Wind Power Generator



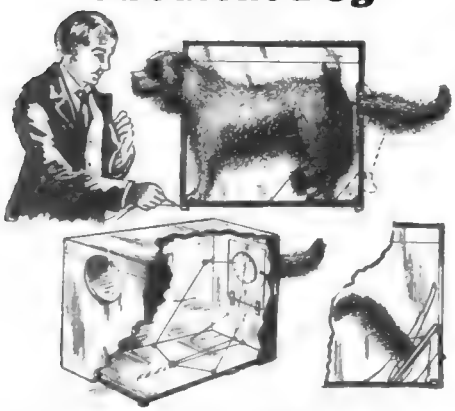
The invention illustrated above is for the purpose of obtaining power from the wind in a manner different from that found in the windmill. A large funnel catches the wind which then passes downward to an air turbine. This air turbine drives a generator. The wind then operates another air turbine and then passes upward to the top of the hill where a venturi effect tends to increase the draft in the system.

Dial Indicator



The radio station indicator illustrated here seems at first glance to be a very practical system. Each dial is turned to a setting corresponding with the dials at which the station is heard, and then it becomes a simple matter to locate the settings again. In view of the fact that there are but few amateurs who do not receive more than a dozen stations, we wonder what the size of this indicator would have to be.

Obedient Dog



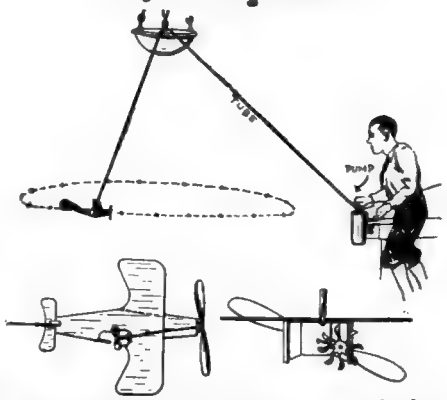
The dog illustrated above wags its tail up or down or to either side at the command of his master. There is no reason why he wouldn't do so because the dog's tail is operated by strings from a distance.

WANTED

ARTICLES pertaining to automobiles such as handy kinks, roadside repairs and anything of interest to the man who drives a car. $50.00 in prizes every month are offered by MOTOR CAMPER AND TOURIST for such articles. Get a copy at your newsstand and see what is wanted. If your newsdealer cannot supply you send for free sample copy to:

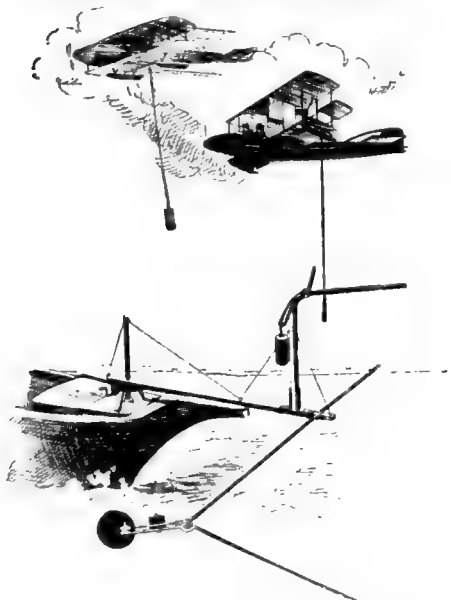
MOTOR CAMPER & TOURIST
53 Park Place,
New York City.

Toy Airplane



This airplane operates by compressed air. The details of its construction are shown above.

Plane Fuel Supply



Phonograph Records

No. 1,458,603 issued to Hartwell W. Webb. Mr. Webb has demonstrated that it is possible to make phonograph records by causing the diaphragm to operate a shutter beneath the ray of light, which light effects the silver coating on a specially prepared record.

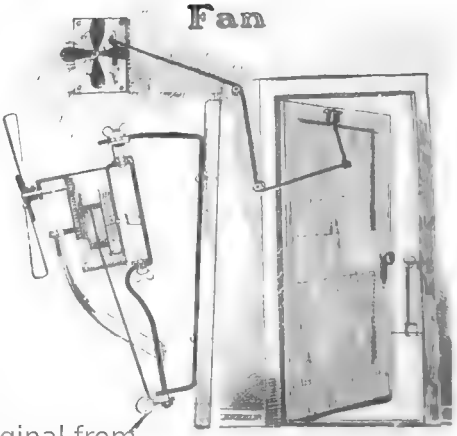
LEFT

No. 1,479,221 issued to Godfrey L. Cabot. Attached to a vessel is a suitable arm which may be rotated. At the extremity of this arm there is a forked socket which is to receive the free end of the cable let down from the airplane. This then picks up the tank of fuel.

RIGHT

No. 1,468,617 issued to Arvid F. Carlin. A cable is secured to the door of the room and terminates over a drum on the fan. The drum winds a spring motor causing operation of the fan, and the visitors supply the energy.

Fan



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Scientific Humor

IT WAS A DEVELOPER THEY NEEDED

A photographer who kept some plants in his studio was watering them one day when a friend happened to come in to see him.

"Look here, Jim", said the photographer, "I'm having a lot of trouble with these plants. They all seem to be drying up; maybe you know something about them."

"Oh," said his friend, after a moment's consideration, "put some 'hypo' on them; that will 'fix' them."—*Harry J. Walters.*

SPECIFIC GRAVITY

JOHN: "My father was running his car so fast from a revenue officer that he ran into the river."

JAMES: "Oh! Did he sink?"

JOHN: "No, his car was so full of corks it just floated across."—*Clarence Tibbs.*

WASN'T THE WRONG NUMBER

"Just think, Mother, Johnny couldn't tell the teacher who discovered America or when it was discovered!"

"Why, Johnny", said mother, "did you never see 'Columbus—1492?'"

"Yes, but I thought that was his 'phone number."—*M. Kipp.*

CAN'T HELP IT—HIS RESISTANCE IS LOW

The tired business man may still be tired,
As homeward-bound he wends his weary way;
But when the evening meal is through,
The radio he ambles to
And listens 'till the break of day.
—*Earle Bennett, Reporter No. 12,157.*

A NEW SCIENTIFIC WRINKLE

"Micky," said that young hopeful's mother, "Micky will you pour me some tea?"

After some moments the ingenious youngster returned from the kitchen bearing the cup of tea.

"Why, Mickey," said his mother as she sipped the tea, "It's full of specks."

"Well, Ma," he replied, "I couldn't find the strainer so I used the fly swatter."—*Ethel Judevin.*

ON NEUTING A NEUTRODYNE

"A scientist has announced the discovery that the human face is getting longer."

"Wonder where he made the observations for his conclusion."

"Probably spent a day with the income tax collector."—*Edith Lochridge Reid.*

STIFF METHODS

A Professor was explaining to a class the effect of dynamic electricity upon the human body, when he suddenly collapsed because he accidentally touched the switch by his side. When he recovered his senses, he asked the class: "Did you observe what occurred?"

CLASS: "Yes."

PROFESSOR: "I did it for your benefit—to give you an ocular demonstration of my explanations."—*Aurelio Rivera.*

First Prize $3.00

STUNG!

1st ANT: "When scientists want to solve a problem they study us insects."

2nd ANT: "Yes, they stole our antenna secret for their radios."

MOSQUITO: "But you haven't contributed any secrets which will save a human from death like we have."

BOTH ANTS: "What did you do?"

MOSQUITO: "Well a mosquito performed the first successful blood transfusion." *Franklin Price,* Reporter No. 12655.

SWANEY STUFF

A Zebra is a "Sport Model" of a Jackass.—*M. G. Tewksbury.*

WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. We cannot return unaccepted jokes. Please do not enclose return postage.

All jokes published here are paid for at the rate of one dollar each, beside the first prize of three dollars for the best jokes submitted each month. In the event that two people send in the same joke so as to tie for the prize, then the sum of three dollars in cash will be paid to each one.

HE GOT HOT

WIFE: "John I'll never take you to another dinner party."

"Why?" he calmly asked.

"You asked Mrs. Bones how her hubby was standing the heat."

"Well?"

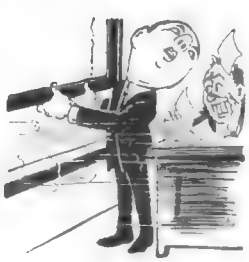
"Well her hubby has been dead for two months."—*H. B. Dahl.*

IT'S ELEMENTAL, ANYWAY

PROFESSOR (thinking of gold): "What metal is used by women most?"

BEGINNER IN CHEMISTRY: "Alimony!"—*L. Fish.*

DRAFTED



SHE: "I heard you got a job."

HE: "Yes, I'm a draftsman."

SHE: "Not really?"

HE: "I open windows."—*Harry Hirst.*

WOMAN THROWS A HOT FLAT-IRON AT MATE

Once more we have a rather practical example of the good old adage, "Strike when the iron is hot."—*L. J. Smith.*

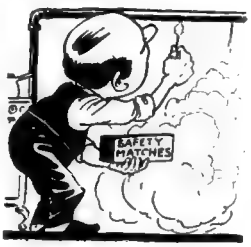
THAT'S WHY HE'S INSULATED

PEARL: "There goes electric Harry."

EARL: "Why do you call him electric Harry?"

PEARL: "'Cause he shocks all the girls that he gets in contact with."—*Arthur Berland.*

S. O. S.



DOCTOR: "But surely my dear good man, you weren't so mad as to look for escaping gas with a match?"

PATIENT: "Well, Doctor, it was a safety match."—*Jacob Karelitz,* Reporter No. 13537.

PROOF ENOUGH

MRS. PAT: "Faith, and there won't be any radios in heaven."

JUST PAT: "Begorra, an' I don't believe it!"

MRS. PAT (reading from Bible, Rev. 8:1): "There was silence in heaven about the space of half an hour—don't that prove there won't be any broadcastin'?"—*Joseph M. Straughan.*

STATION DAMN

AL FALFER: "I've found a way to keep my hired man all summer."

AL SIKE: "Buy 'im a radio?"

AL FALFER: "Nope; buyin' the parts for one. He's goin' to put it together in the evenings."—*Clarence Swanson.*

BREAKING INTO THE FILMS

"The druggist gives a tube of toothpaste with every camera sold."

"Why the toothpaste?"

"O, that's to remove the film.—*Howard P. Sedgwick.*

A SAD TUNE

SCHOOL TEACHER: "Johnny stay in after four. You did not locate any of the places."

JOHNNY: "I may not be able to locate them, but I can tune them all in."—*O. E. S. Gardiner.*

EUREKA!

The editor of an electrical journal sent the following to a contributor from a mid-western town:

Dear Sir:—

Drop all work and come at once!

We must have you on our editorial staff, also as a consultant in the electrical laboratory we maintain. Name your own terms.

You have clearly demonstrated that you are another Charles P. Steinmetz. Mr. Steinmetz submitted, and we accepted, the very same article about nine years ago that we received from you last week.—*Clarence Original*

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Original from UNIVERSITY OF CHICAGO

THE ORACLE

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:

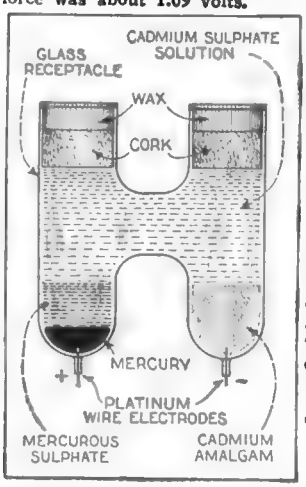
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

STANDARD CELLS

(1760) Cornelius Winter, Menno, South Dakota, asks:

Q. 1. Kindly explain the life of the standard cell?

A. 1. In the early days when the only electrical instrument was the telegraph, Daniell cells were used extensively and were the first accepted form of standard cell. The electromotive force was about 1.09 volts.



Here is a diagram of the universally adapted Weston standard cell. This cell forms a unit of electromotive force and at twenty degrees Centigrade, the voltage of the cell is 1.01830. The glass receptacle is H shaped.

Latimer Clark in 1872 devised a cell which for a long time did not command attention, but which was finally adopted and known as the Clark standard cell. In 1884, Dr. Weston devised a much better cell in that it was more stable, more constant in its output, had less errors due to temperature changes and in general had a much greater longevity. Finally, in 1893, Dr. Weston built the super-standard cell, known today as the Weston Standard Cell and adopted universally as the standard of electro-motive force. In the main, it consists of a glass receptacle in the form of the letter H. The positive electrode consists of pure mercury over which is placed a quantity of mercurous sulphate to prevent polarization during use. The negative electrode consists of an amalgam of mercury and metallic cadmium. At 200 Centigrade, the voltage of this cell is 1.01830. A resistance never less than 10,000 ohms, but more nearly 1,000,000 should be used with this cell.

ELECTRIC TIMER

(1761) C. I. Ways, Cumberland, Md., wants to know:

Q. 1. How can I construct an electric timer to record the exact time that it requires a motorcycle to traverse a course 1,000 feet long?

A. 1. A rather powerful spring is kept taut by a string stretched across the path of the course. As soon as the motorcycle hits this string and breaks it, the spring causes the contact arm to come into momentary contact, thus closing the circuit which actuates the magnet and starts the clock. Similarly, when the course has been finished, another pull on the armature causes the watch to stop. Two storage batteries should be used for the electro-motive force. They are connected in series, thus giving 12 volts.

A powerful magnet can be made by using a soft iron core composed either of iron wires or soft iron rod and wound with No. 28 B and S, D.C.C. or S.C.C. wire. Two hundred turns at least will be required. The resistance of a braided conductor of No. 16 wire will be less than 9 ohms for 2,000 feet and using 12 volts, you will have at least one ampere of current to operate the magnet.

Radio Controlled Television Plane

One of the most destructive war engines of the future is fully described with large wash drawings in the November issue of

THE EXPERIMENTER
(Formerly Practical Electrics)

This article by Hugo Gernsback describes how airplanes can be directed without a human being on board and plant bombs with accuracy.

Interesting Articles to Appear In November Issue of The Experimenter

Sensitive Microphone Used as Divining Rod in Water Finding.
By C. A. Oldroyd.

Illumination of State Fairs.
Laboratory Manipulation.
By T. O'Conor Sloane, Ph.D.

Building a Power Vacuum Tube.
By Dr. Russel G. Harris, Harvard University.

Single Tube Reflex Experiments.
By Clyde J. Fitch.

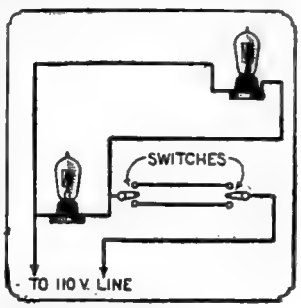
ELECTRIC LIGHT CIRCUIT

(1762) John A. Martin, Jersey City, New Jersey, asks:

Q. 1. Please give me the circuit for lighting or extinguishing two lamps operating on a circuit at a pressure of 110 volts from two different places, using if possible a simple switch.

A. 1. Although we do not recommend the use of any but approved switches for a circuit of this kind, we are giving the circuit in the diagram below. The switches may be placed anywhere.

Using two simple switches, the circuit to the lights may be opened or closed from two different places such as the head and bottom of a staircase, or the vestibule and hallway of a residence.



SOURING OF MILK

(1763) Martin Pietney, New York City, N. Y., asks:

Q. 1. Is it a fact that lightning sours milk?

A. 1. Lightning itself does not sour milk. The ozone or nitrous compounds may have something to do with it.

COLD LIGHT

(1764) Carl E. Uneverzert, Buffalo, New York, states: As is well known, by focusing the rays of the sun with a convex glass, we not only focus the light rays, but also the heat rays. A question then arises—Is it possible to focus but one of these at a time and how?

A. 1. By the use of two clean photographic plates and a few pieces of wood, a ray filter can be made. This when interposed between the rays of the sun and the lens and filled with water, causes no loss in illumination at the focus, but does lower its heat. Upon the addition of a clear solution of ordinary alum to the filter, the point of focus will be found at room temperature and the light will be very little diminished. It may be interesting to know that upon filling an empty filter with a solution of iodine in carbon disulphide, the light will be completely shut off, but the focus will be as hot as ever, the invisible heat rays readily melting ice or burning paper.

OUR $12,000 PRIZE CONTEST

IT will be noted from recent issues and the present one that our prize contest has been a whale of a success. Over $1,500 has been paid out this month for worth while contributions to SCIENCE AND INVENTION, either in pictures, suggestions, ideas or articles. We now have on our staff, close to 14,000 correspondent reporters who are scouting the world for new material that can be written up for SCIENCE AND INVENTION. And the formula is simple—just keep your eyes open. Even if you were totally deaf or blind, you could still win a prize by simply using your head and sending us ideas of a scientific nature, or of a nature directly or indirectly attached to new inventions.

ARTICLES FOR DECEMBER SCIENCE AND INVENTION

A Huge Skyscraper Park For Cities.
Science and the Future.
Oil Flames to Defend City.
Sinking Caissons For Bridges.
By W. B. Arvin.

By-Products of the Automobile Exhaust.
By O. Ivan Lee.

Photographing the Moon By Earth Light.

The Modern Art of Cremating.

The Family Life of Ants.
By Dr. Ernest Bade.

Cements—How to Make and Use Them.
By Ismar Ginsberg, B. Sc., Chem. Eng.

The Colorado Shower of Meteorites.
By Charles T. Dahama, Ph. D.

New Atlantic Cable Speeds Up Transmission.

More Exposés of Movie Comedies.

A Remarkable English Model Railway.

The Usual Live Radio Department—Including Plenty of Radio Wrinkles.

FREE INFORMATION

IF you want additional information concerning any of the subjects illustrated and described in this number of SCIENCE AND INVENTION we shall be glad to give you other data we have at our command. To make this work as easy as possible for our editors, please be brief. Write only on one side of the paper and state exactly in a few words just what it is you desire further information on. We have the original manuscripts and drawings of many of these articles in our files and can furnish much additional data in most cases. Please do not fail to send stamped and self-addressed envelope. Make all questions concise and specific.

Address all inquiries of this nature to INFORMATION EDITOR c/o Science and Invention, 53 Park Place, New York City.

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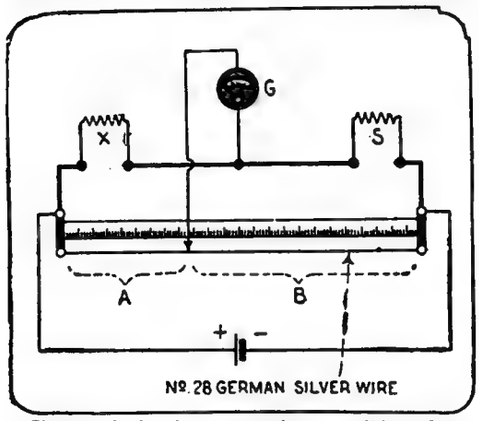
SLIDE WIRE BRIDGE

(1765) E. L. Cumbee, West Point, Ga., asks:

Q. 1. Kindly describe the slide wire bridge in full?

A. 1. If a current from a battery divides between two conductors, the resistances of these branches may be very different and consequently the current in one may be much larger than in the other, but since they both start at the same point and end together at another common terminal, the fall of potential must be the same in each and there must be a point in both where the potential is exactly the same. The slide wire bridge is simply an arrangement whereby resistances of low value may be exactly determined in comparison with a known standard. The unknown resistance



The method of constructing a slide wire Wheatstone bridge for measuring resistances is shown above. By a simple arithmetical procedure the unknown resistance is quickly found.

is placed at X, and the known resistance, anywhere in the order of a fraction of an ohm to 1,000 is connected at S. A No. 28 German silver wire is connected to two heavy terminals spaced usually one meter or one yard apart; any other standard of length could be used. Then by adjusting the sliding contact on the resistance wire, after a small electro-motive force has been connected to the terminals, the galvanometer may be made to show no deflection. When this occurs, then the two points in the divided circuit of exactly the same potential will be known by the position of the sliding contact. Hence, the resistance of X must be to the resistance of S as the resistance of A is to the resistance of B. In the case of a practical example where S is 500 ohms, A is 9 inches and B, 27 inches, X would be equal to 166.7 ohms.

If the potential of 1½ volts from an ordinary dry cell were applied to the terminals of the bridge, the current through the resistance wire would be approximately .40 of an ampere, whereas that through the known and unknown resistances would be but .0022 ampere.

SPEED OF SYNCHRONOUS MOTOR

(1766) Robert Burton, Rochester, New York, says he has a six pole synchronous motor and would like to know at what speed it revolves, there being no indication on the name plate.

A. 1. If your motor is a 120 volt motor it will revolve at 1200 revolutions per minute, the formula for obtaining the speed being as follows:

$$\text{R.P.M.} = \frac{2f}{p} \times 60,$$

where f is the frequency in cycles per second, P, the number of poles.

$$\text{R.P.M.} \therefore = \frac{120}{6} \times 60 = 1200 \text{ R.P.M.}$$

ELECTRO-CHEMICAL EQUIVALENT

(1767) Richard K. Knox, Pasadena, Calif., asks:

Q. 1. What is and how can I determine the electro-chemical equivalent of a substance?

A. 1. Hydrogen gas is used as a basis in determining what is known as the valence or power of an element to unite with another. Since it takes 1 coulomb of electricity (1 ampere per second) to liberate .000010384 grams of hydrogen from any electrolyte containing hydrogen in combination, other elements will be liberated to a smaller or larger degree depending both on their atomic weight and on their valence. For the determination of the electro-chemical equivalent the following formula is used:

$$E = \frac{AW}{V} \times .000010384;$$

where E is the electro-chemical equivalent, AW is the atomic weight and V the valence.

SELENIUM SOLVENT

1768) George Ormonde, Ellenville, N. J., asks:

Q. 1. What will dissolve selenium readily?

A. 1. Sulphuric acid will very readily dissolve selenium.

Q. 2. I have a belt 3/16 of an inch thick and 4 inches wide. What horsepower will it safely transmit? The belt is to be operated from a motor and is to be moved at 2000 feet per minute

A. 2. The belt, if of ordinary durable straight grain leather, will safely transmit 8 horsepower.

STRENGTH OF MAGNETS

(1769) Rupert Buckley, Sacramento, Calif., wants to know:

Q. 1. How does a speedometer work?

A. 1. A speedometer, whether friction or gear drive, works on the same principle as the tachometer. Several types have an ordinary regulating governor such as used on the phonograph and a centrifugal throw-out clutch is used to engage a drum wheel to which is attached a pointer.

Q. 2. What is a neon lamp?

A. 2. A neon lamp is an ordinary glass bulb containing the rare neon gas and having two electrodes to which potential is applied. A potential of 220 volts is the average used, although there are many types that require several thousand volts for operation.

Q. 3. Does the strength of magnets with a given current and a given number of turns vary with the shape?

A. 3. The shorter a magnet is or the closer the opposite poles are to each other, the more powerfully will the magnet attract its armature and hence a magnet 1½ inches long would be several times as powerful in this sense as one four inches long, both consuming the same current.

STEAM GAUGE

(1770) William A. Kniffir, Mackinaw City, Mich., asks:

Q. 1. Will you please tell me how a steam gauge operates?

A. 1. In the most simple forms, a steam gauge consists of a tube of brass of elliptical section bent into nearly a complete ring. One end of the tube is free and is closed and into the other, which is fixed, the steam under pressure is admitted. To the free end is connected by means of a small chain, the pointer counter-balanced by a fine hair spring. If pressure is applied to the gauge, the elliptical section of the tube tends to become more nearly circular in cross section and in so doing will slightly unbend as if to straighten out. This causes the chain to rotate the spindle upon which the pointer is fastened with the result that the pointer will follow the variations in the pressure. In practice the steam gauge is usually so arranged that the pipe leading to it is bent downward so that it fills with condensed water thus preventing the hot steam from reaching the expensive gauge.

IMPORTANT

TO NEWSSTAND READERS

IN order to eliminate all waste and unsold copies it has become necessary to supply newsstand dealers only with the actual number of copies for which they have orders. This makes it advisable to place an order with your newsdealer, asking him to reserve a copy for you every month. Otherwise he will not be able to supply your copy. For your convenience, we are appending herewith a blank which we ask you to be good enough to fill in and hand to your newsdealer. He will then be in a position to supply copies to you regularly every month. If you are interested in receiving your copy every month, do not fail to sign this blank. It costs you nothing to do so.

To ..... Newsdealer

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Please reserve for me.....copies of SCIENCE & INVENTION every month until I notify you otherwise, and greatly oblige,

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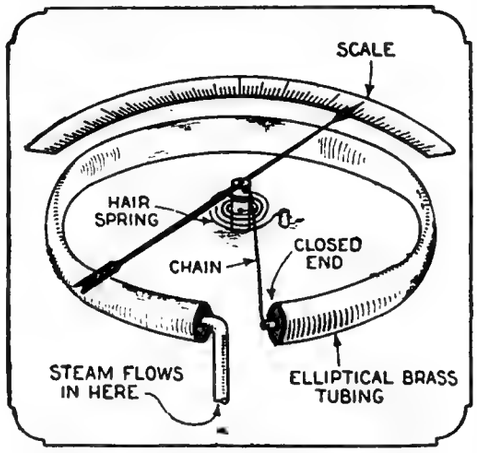


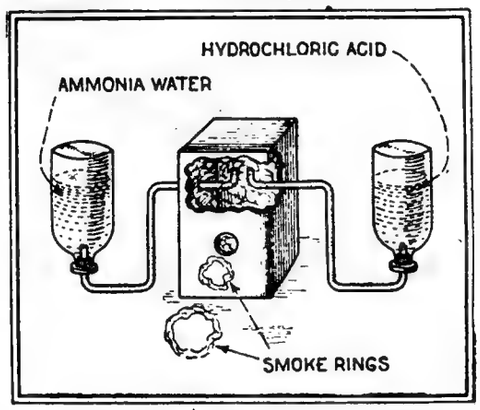
The method in which a steam gauge operates is indicated in the diagram above. The elliptical tubing tends to become circular in cross section and straightening, operates the needle.

SMOKE RINGS

(1771) Anthony Linder, Utica, N. Y., asks:

Q. 1. Please describe a simple method for producing smoke rings which will be of a more lasting and more pleasing appearance than those I have succeeded in making with ordinary smoke?

A. 1. If a bottle of strong ammonia water and one containing concentrated hydrochloric acid are



The system of making smoke rings and supplying a constant amount of smoke is indicated in the above diagram. Inverting the bottles and forcing through the liquids and into the box is another satisfactory way.

arranged as shown in the diagram, the fumes generated inside the box will become very dense in a short time. They will be astonishingly white. This is the result of the combination of the ammonia and hydrochloric acid to form ammonium chloride. If a large pasteboard box or a cigar box or even a tin can is used, a gentle rap on the back will produce amazingly beautiful white rings. The bottles are supported so that the level of the liquids in the glass tubes is below the ends, else there will be needless waste due to overflow.

CORE QUERY

(1772) Jesse B. Ellis, Los Angeles, Calif., asks:

Q. 1. Why could not large transformers, armatures and fields of motors and generators be molded from a mixture of powdered iron or magnetic oxide of iron? With the use of a suitable binder which would not be an insulator of magnetism, would not the permeability of such a core have negligible low losses and be much more easily and quickly constructed than to build up of laminations?

A. 1. The reason why powdered iron held together with a suitable binder would not be practical in the ordinary armatures and fields of motors and generators is that a suitable binder is not available and that although the permeability of powdered iron is high, its efficiency, were its strength sufficient to be of use, would be low on account of the intervening gaps.

MARBLE CEMENT

(1773) Benjamin Ladner, New York City, asks:

Q. 1. Kindly give me formula of a suitable cement in order that I may fix a broken marble table top?

A. 1. In order to repair the broken table top you will have to do as follows:

Prepare the cement consisting of four parts of gypsum and one part of finely powdered gum arabic. These are thoroughly mixed. A cold solution of borax is then made, using ordinary 20 Mule Team borax in water and the powders are mixed into a thick paste with this. This paste is then quickly smeared on each face of the parts which are fastened together tightly. They are left for a week. This gives a joint that is as "strong as iron" and will last as long as the table top.

ELECTRICITY IN ATMOSPHERE

(1774) Stanley Minor, Heppner, Oregon, asks:

Q. 1. How do you account for the electrical disturbances in the atmosphere?

A. 1. Electricity is not only produced by friction, but by mechanical and chemical means also. It may be that the reason for electricity being prevalent in the atmosphere is due to the vaporization of the moisture on the earth, and condensation of the small particles assuming electrical charges. The charges on the surface increase as the square of the surface area. As these particles form, they unite and form larger particles. The potential increases much more as the surface area thus is diminished, and when a cloud is formed, the potential often becomes great enough to cause sparks many miles long.

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Awards in $1000 Monthly Contest

The Regular Departments Pay Prizes of Their Own. Authors on Contract Receive Their Own Rates; this, With Other Special Payments Makes the Total Paid for Articles in Excess of $1500.00 Monthly.

FIRST PRIZE $100.00

Gold from Mercury, by Dr. Alfred Gradenwitz 654

TWO PRIZES OF $50.00 EACH

Hero's Automotor Dating 200 B. C., by Chas. B. Bunnell.....662-663
A Real Short Wave Receiver, by Alfred R. Marcy, 2DK..... 690

TEN PRIZES OF $25.00 EACH

Will New York Be Destroyed by Earthquake?, by Rev. Father Francis A. Tondorf 655
Death Dealing Rocket (author please send address)..... 656
Some Weird Stage Effects, by Dr. Albert Neuburger..... 656
The Problem of Saturn's Rings (author please send address)..... 664
Making One Room Into Three (author please send address)..... 666
A Novel Third Degree Method, by Andy Gilbert..... 667
Handling the Nation's Grain, by Clarence A. Snyder, Reporter No. 2434 667
X-Ray Finger Prints, by Charles K. Fulghum..... 669
Cheap Radio Primary Cell, by Dr. Ernest Bade..... 682
Bicycle Wheel Toys Easily Made, by C. H. Van..... 683

FIVE PRIZES OF $20.00 EACH

Early American Patents (author please send address)..... 668
The Angler Fish, by Dr. W. H. Ballou..... 669
The Work of Tycho Brahe, by Hubert Slouka, Reporter No. 7110..... 670
A Rain of Fish (author please send address)..... 671
Sensitive Micrometer, by C. A. Oldroyd, Reporter No. 4433..... 680

TEN PRIZES OF $15.00 EACH

Building a Cider Mill, by Tud Garber..... 680
Steam Propelled Model Boat, by F. E. Peterson..... 681
Rocket Propelled Speed Boat, by C. A. Oldroyd..... 681
Marvelous Number Squares, by A. Gruntal..... 682
Heat Operated Pecking Bird, by Dr. E. Bade..... 683
Retransmission From Airplane, by S. R. Winters..... 686
In the Train Radio (author please send address)..... 688
Uses for Cartridge Fuses, by A. Blumenfeld..... 689
Loop Mounting, by L. B. Robbins..... 689
"Children, We Shall Now Begin the Radio Class," by Alfred Pogany, Reporter No. 10236 693

TWENTY PRIZES OF $10.00 EACH

Balance Kink, by Esten Moen..... 684
Burglar Alarm (author please send address) 684
Magnification, by Done Home..... 684
Save Punctures, by F. Formos 684
Filling Balloons, by W. L. Todd 684
Ribbon Inker, by K. B. Murray 685
Indicator, by J. F. Welhelm 685
Boiling Eggs, by Richard Fielder 685
Orange Fireworks, by Dr. A. Neuburger 685
Embossing Foil, by James E. Noble 685
Celluloid Ball, by Arthur Johnson, Reporter No. 5877..... 685
Glacier Mill, by Dr. A. Neuburger 685
Ice Pick Holder, by Herbert E. Morris, Reporter No. 9363..... 685
Stand-Off Insulator, by Lewis M. Baldwin 717
Nature's Loud Speaker, by Carl G. Novotny..... 718
Loading Coil, by William Teppo 718
Filament Switch, by R. G. Carpenter 719
Phonograph Talker, by Edward Widdis, Reporter No. 8997..... 719
Spark Intensifier, by Thomas C. Maffet 719
R. F. Transformer, by J. Durward Miner, Jr..... 720

TEN PRIZES OF $5.00 EACH

Fixed Condensers, by W. H. Goodson, Jr..... 717
Socket Mounting, by Edwin Eilers 720

(No further entries)

TO the individual who casually glances at the above list of prize winners, it may seem that the list is shorter than usual. This, however, is not the case. The total in awards is considerably higher than previously. This is primarily due to the fact that announcements are made of the prize winning ideas in the $500.00 Gold Cover Contest on pages 676, 677 and 678. We refer the reader to those pages and respectfully ask the girls and women to pay particular attention to the number of prize winning ideas which were won by the members of the fairer sex. We also desire to impress upon the reader and prize seeker that a great many of the articles are written by staff writers or are contracted for. Such articles are not paid for from prize award moneys, and consequently the readers' chances for winning a prize are infinitely greater than he may at first believe them to be. To assist readers in securing proper material for publication, we suggest that they carefully read the article on the bottom of this page dealing with the distribution of reporter cards. We further request that those who send articles to the magazine see to it that their name and address appears not only on each page of their contributions, but also on the drawings, and models. We try to avoid losses of names or addresses as much as possible, but this cannot always be done.—*Editor.*

Here Is How You Can Get in the Contest:

$12,000 or More in Gold

EVERY month SCIENCE AND INVENTION pays $1,000 or more in gold in prizes. Every text article published will receive a prize—(most of the departments have awards of their own which they give every month). Ideas are what the Editors want. The ideas must be told simply, so that your mother or your sister can understand them—in pictures or sketches or both. But the idea must be new and must have something to do with science or invention.

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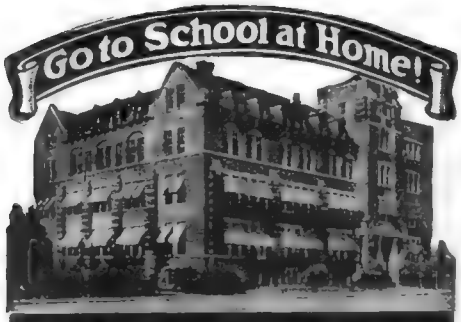

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Dr. Hackensaw's Secrets

By CLEMENT FEZANDIÉ

(*Continued from page 661*)

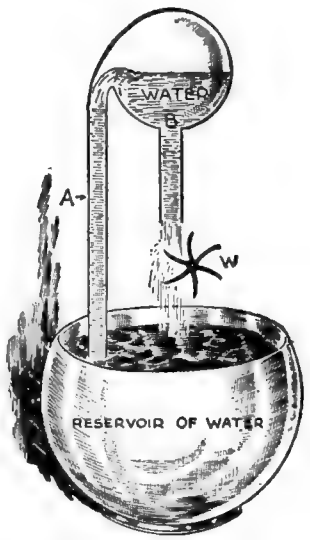
CHAPTER 2.

It was rather late at night when Dr. Hackensaw and Pep reached the mountain where the perpetual motion machine had been erected.

Pep was disappointed. She had expected to see some huge contrivance, but all she saw was a closed metallic cylinder about twenty feet in diameter and ten feet high, arranged so it could slide up and down in a tall, strong framework.

"There!" exclaimed Doctor Hackensaw triumphantly. "That's the machine. Once the button is pressed, that cylinder or car as I call it, will begin to rise and fall in these guides, and its reciprocating motion will by suitable gears turn this dynamo you see."

"But how does the thing work?" asked Pep.



One of the simplest proposals for a perpetual motion machine is that shown above. Read Dr. Hackensaw's explanation of it.

"It works by means of a gravitation screen at the bottom of the car. I told you some months ago that there was no more reason why we shouldn't find means to shut off gravitation than to shut off heat or light or sound. And I found the means of constructing a gravitation screen, and sent Miggs off on a trip to India. Well, curiously enough, I didn't realize at the time that I had discovered perpetual motion, but the idea struck me all at once, and the result is this machine that you see here."

Doctor Hackensaw paused here for a moment, and then continued impressively: "At the bottom of this heavy cylinder that you see here, is a gravitation screen that may be opened or closed at will. When closed, the attractive force of the earth is partially or wholly shut off. The air above the car loses its weight and atmospheric pressure from below will force the car upward with a pressure that can reach as high as fifteen pounds to the square inch. On a surface twenty feet in diameter you can readily understand that the machine will lift tons upon tons of weight. When the car reaches a certain height, the gravitation screen automatically opens and the car descends by its own weight. By means of these gears, work is done both during the ascent and the descent. As the car descends

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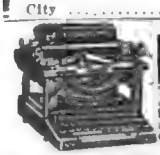

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Dr. Hackensaw's Secrets

(*Continued from page 702*)

the screen automatically closes and the car rises again. And so the machine will keep on working forever. We have here real perpetual motion, for we perform work without the expenditure of any energy."

"Yes," assented Pep, "the same as a windmill or a water-wheel."

NO SUN POWER USED

"No, indeed," returned the doctor. "In a windmill or a water-wheel we obtain energy from the heat of the sun. The sun has lost that energy. But in the case of my machine, no energy has been lost. Gravitation has done the work and we have no reason for believing that the earth has lost any of its power of attraction. I could build thousands of these machines, manufacture heat, light and power enough for all the needs of the earth, and yet the power of attraction of the earth would not be reduced one particle. In the case of heat emanating from the sun the heat is not replaced—the sun must grow cold some day; but this power I obtain from gravitation is power I obtain for nothing—in a word it is true perpetual motion. This machine, Pep, will revolutionize all industry and all transportation. I have solved the problem of getting something for nothing."

"But," objected Pep, "it must take some power to open and close the gravitation screens."

"Almost nothing. A few pounds' pressure suffices and I have tons of power at my disposal. This invention is bound to be the most profitable of the many profitable inventions I have made. It will bring me in not *millions* of dollars, but *billions* of dollars. There will be no more use for coal or petroleum because I can obtain unlimited electrical power at a trifling expense!"

"Well, doctor, shall I press the button and set the machine going?"

"Not tonight. It is too late. Better wait until morning!"

CHAPTER 3

In the middle of the night, Pep was suddenly awakened by a rough hand placed over her mouth while a hoarse voice whispered in her ear:

"If you make the least noise, kid, I'll slash your throat as I did Doctor Hackensaw's!"

And to Pep's inexpressible terror, as the man turned on his flash-light she saw that the villian was masked and that both his hands were covered with blood. As a rule she did not lack courage, as she had shown on more than one occasion, but now she was so terrified that she offered no resistance as the man gagged her and tied her hands behind her back.

"Now, kiddo," said the burglar, "lead me to the place where Doctor Hackensaw left his bag. I know he brought a bag full of greenbacks with him to pay off his men here, and I happen to need the money more than he does!"

As the fellow said the words, Pep remembered that the Doctor had deposited his satchel inside the anti-gravitation car, and she accordingly obediently led the way thither, followed by the burglar.

"Oh, it's in there, is it?" said the man, as he came to the perpetual motion machine and threw open the door. "Yes, I see it!" and he climbed into the car.

Then Pep recovered her wonted energy. With one kick of her bare feet she slammed the door closed, and then, with the skill of a ballet-dancer she pressed down the starting switch with her toe, although the switch was at a higher level than her head.

(*Continued on page 706*)

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Dr. Hackensaw's Secrets

(*Continued from page* 704)

THE MACHINE WORKS

Instantly the machinery began to work, and Pep felt a strong current of air as the car, slowly losing its gravity began slowly to ascend in the guides until it reached a certain point, and then descended again, this up and down motion continuing while Pep vainly struggled to free her hands or get the gag out of her mouth. Failing in both these objects she started to run back to the house to alarm some one, when suddenly she heard a loud crash and saw the car ascend to the very top of the guides, where something gave way and the car shot up into space. The villain in his desperate efforts to escape, had evidently completely closed the gravitation screen. And then the screen must have automatically opened again, for a few seconds later the car fell to earth with a crash and broke open, revealing the crushed and lifeless body of the villain.

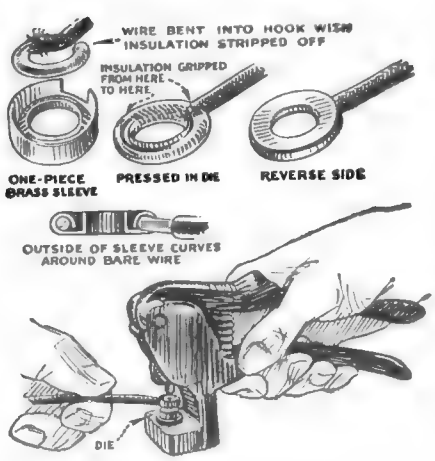
* * * * * * *

"No indeed, Pep," said Doctor Hackensaw, genially. "The fellow didn't even try to harm me. I see he searched through my room, and not finding my satchel there, he thought he could frighten you by showing you a pair of bloody hands and telling you he had cut my throat. You can see that it was imitation blood he used—not a bad idea, because it impresses a woman and keeps her from screaming. I would rather have lost the few thousand dollars though, than to have had him ruin my machine. It will take me months to build another one. But you were a brave girl, Pep, and I'm glad you outwitted him, because he might have taken it into his head to kill you, in order to make sure of getting off safely with the cash!"

As for Pep, once she was assured of the Doctor's safety, she was jubilant and she was never tired of recounting to her friends her adventure with the burglar. Poor Doctor Hackensaw got very tired after a while of listening to these endless repetitions and he even went so far as to remark one day to Silas Rockett:

"Do you know, Silas, I verily believe the nearest approach to perpetual motion in this world, is a woman's tongue!"

WIRE LUG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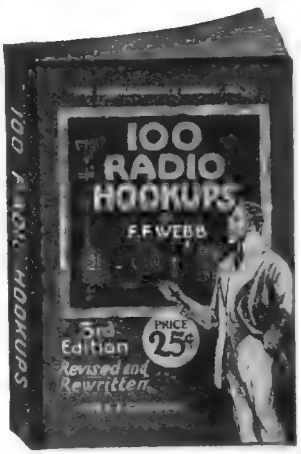

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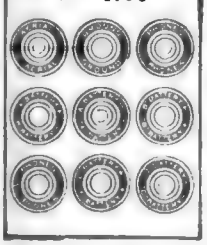
4850 25c

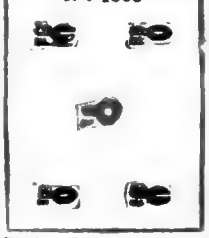
"RASCO" NAME PLATE ASSORTMENT Nº. 4994



This Name Plate Assortment Packet contains Nine Binding Post Name Plates as follows: one Aerial; one Ground; two Phones; one "A" Bat. —; one "B" Bat. +; one "A" Bat. + "B" Bat. —; one "C" Bat. +; one "C" Bat. —.

N4994 Nine Name Plate Assortment $0.20

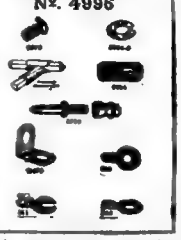
"RASCO" LUG ASSORTMENT 50 LUGS 5 DIFFERENT STYLES Nº. 4995



This Lug Assortment Packet contains fifty of the most important lugs for the man who "Builds His Own" as follows: 10 lugs for 8/32; 10 for 6/32; 10 prong lugs (solderless) 6/32; 10 ditto 8/32; 10 flat type 6/32. All lugs are tinned.

N4995 Lug Assortment $0.22

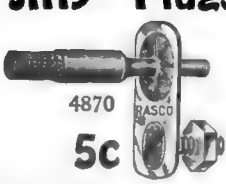
"RASCO" RADIO NEEDS ASSORTMENT 108 PIECES Nº. 4996



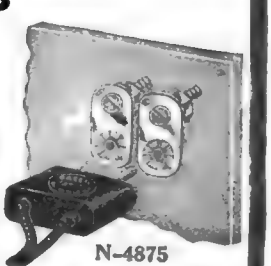
This assortment contains 108 pieces as follows: 36 "T" Wire Bus-Bar Connectors; 4 Adapter Bushings (to fit ¼" dial to 3/16" shaft); 4 Separable Phone Tips; 4 Angle Brackets; 24 Lock Washers; 36 Assorted Lugs, already tinned for easy soldering.

N4996 "RADIO NEEDS" Assortment $0.48

"RASCO" "Jiffy" Jacks and "Jiffy" Plugs



5c



20c

Again, Rasco leads with a small but important radio novelty. JIFFY JACKS are the simplest, and most efficient Cord Tip Jacks ever designed. Stamped from a single piece of metal they grip any style cord tip from any make phone or loud speaker. The JIFFY JACKS take but a minimum of room. All you need do is to drill two small holes in your panel and mount the JIFFY JACK with screw and nut furnished. **No soldering necessary** as the wire goes right on the screw. X-ray view shows how two of the jacks are used in conjunction with our **Jiffy cord plug.** The jacks go on in back of panel, only screws show in front. JIFFY JACKS take practically no room when mounted and are made of best spring brass that will not wear out. Hundreds of other uses for our JIFFY JACKS. **We will pay $1.00 for every new use for JIFFY JACKS that is accepted by us.**

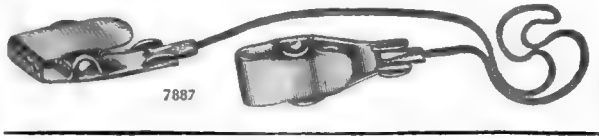
JIFFY PLUGS are made of semi-hard rubber into which the tips of your phones or loud speaker are pushed. The cheapest and simplest plug ever designed. Its small size and neatness made it famous over-night. Size 1 in. long, ½ in. wide and ⅝ in. thick. No tools required. Just wet the metal cord tips and push through openings. Plug can be used with any standard cord tip jack, but best with RASCO JIFFY JACK.

N4875-Two Jiffy Jacks with nuts and screws and one Jiffy Cord Plug.....$0.20

N4870-One Jiffy Jack complete with nut and screw 0.05

N4871-Jiffy Jacks without nuts or screws, two for 0.05

N-4860-Rasco Jiffy Plugs, each..... 0.10



"RASCO" Clip Leads

Here is something that every experimenter has been waiting for impatiently. This is a flexible silk-covered conductor to the ends of which are **soldered** strong brass spring clips.

Instead of using wires to make your connections—screwing and unscrewing binding posts—a clip lead hooks in a jiffy onto any wire, any binding post or other conductor in order to make a safe experimental connection.

"RASCO" CLIP LEADS come in two colors, green and red, to distinguish connections. Brass clips have powerful grip. Length of clip lead, one foot.

N7887 RASCO CLIP LEADS. Each..$0.12

Dozen lots 1.35

"RASCO" Brackets

Here is a line of small brackets evolved especially for the man who "Builds His Own." They can be used in a number of different ways—to hold tuning coil tubes; inductances; spider webs, etc.; to hold up panels; to attach various instruments to baseboards, etc. "Rasco" brass brackets are stamped from heavy metal and have been designed to do the work right. They are nickel-plated and carefully finished.

All illustrations are exactly half-size. Every builder needs at least a dozen of these. Order them now and save money and effort.

N1475 Brass Angle Piece, 5/16" wide x 7/16" high. Each.....$0.03
N1476 Brass Bracket, ¾" high x 2 lugs ½" long. Each..... .05
N1490 Brass Angle Piece, size ¾" x ¾". Each..... .04
N1505 Brass Angle Piece, size 1½" high x ⅝" long..... .05

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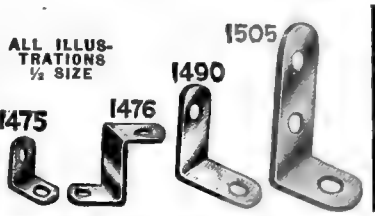

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The Heavens In November

By ISABEL M. LEWIS, M. A.

(*Continued from page 674*)

less numbers when the earth crosses their orbits on or near the dates mentioned.

Objects of special interest visible this month are the Great Square in Pegasus now on the meridian nearly due south, Cassiopeia, which has taken the place of the Big Dipper near the meridian high above the pole, Mars still a beautiful object in the southern sky, and in the east the far-famed Pleiades and Hyades in Taurus. Ruddy Aldebaran is also well in view by this time in the V of the Hyades. The "Eye of the Bull" it has been called though its names mean in Arabic "the Hindmost" because it follows the Pleiades. Another beautiful star now visible in the east is Capella, The She-Goat, with Haedi, The Kids, three stars forming a small triangle, close by on the southwest. Capella is a giant star of the same type as our own sun but with a diameter fully ten times as great. It is at a distance of a little over fifty light years from the earth or about three hundred trillion miles. Were our sun as far away as Capella it would barely be visible without the aid of a telescope. Capella is almost exactly equal in brightness to Vega which has ornamented the evening skies throughout the summer months and which now approaches the western horizon as its rival appears well above the eastern horizon, for the two do not remain long above the horizon together. In Vega, Capella and Aldebaran we see three stars of strikingly different types and colors. Stars such as Vega, white or bluish white, are intensely hot, their surface temperatures being about ten thousand degrees Centigrade or higher; yellow stars, such as Capella or our own sun, have temperatures of approximately 6,000 degrees C. while Aldebaran is classed among the cooler stars with temperatures of three thousand degrees C. or less. Stars much cooler than Aldebaran would scarcely shine by their own light.

A little to the east of the meridian this month in Pisces is the vernal equinox, where the sun crosses the equator going north in the spring. This is one of the two points in which the celestial equator and ecliptic intersect, the other, the autumnal equinox, being now located in Virgo. We have heard of the "Precession of the Equinoxes" which is the slow westward shift of these two points westward along the ecliptic at a rate which carries them completely around the ecliptic in a period of 25,800 years. Some two thousand years ago the vernal equinox was in Aries, the next constellation to Pisces on the east, hence the name "The First Point in Aries" for the vernal equinox, a term which is not frequently used by astronomers, however.

A line from Polaris through Beta Cassiopeiae, the most westerly star in the W, and Alpha Andromedae, in the northeast corner of the Great Square in Pegasus, passes very close to the vernal equinox, Alpha Andromedae, being about half way between Beta Cassiopeiae and the vernal equinox. To the astronomer this is one of the most important points in the heavens, for it is the zero point on the celestial sphere for designating and determining the positions of the heavenly bodies.

Jupiter and Mars are now the only ones among the brighter planets left in the evening sky, and Jupiter is too close to the sun to be seen at the time for which our chart is given. It will be seen low in the southwest soon after sunset early in the month, but by the end of the month will be too close to the sun to be visible.

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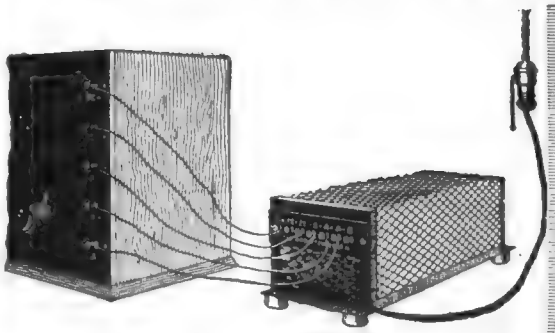

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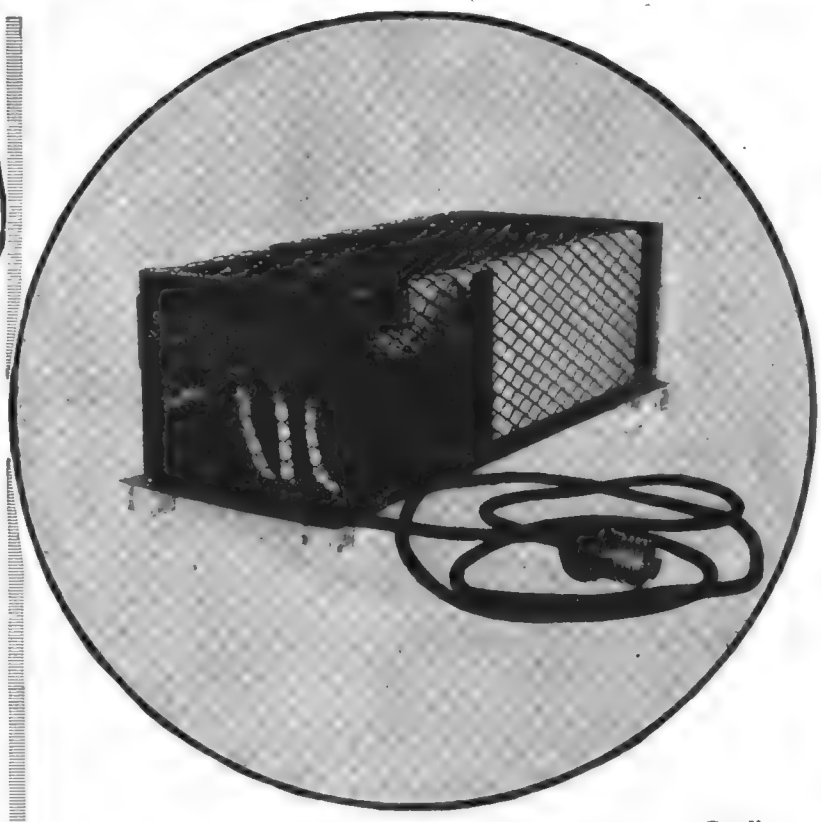

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You can dispose of your batteries. Both A and B types. You can use the large space they occupied for other and more valuable material. You can rid your radio set of the unsightliness of the A and B batteries.

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Entire unit is only 14 inches long by 6 inches wide by 5 inches high. Construction is of the finest materials for dependable long life. The unit is beautifully finished and will not detract from the appearance of the most ornate receiving set.

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Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

ROUND RAZOR BLADES

(836) Wm. VanderLinden, Medicine-Hat, Alberta, Canada, asks for patent advice on a round razor blade of unique type. As a protection to him, we withhold the details for the present.

A. With regard to the safety razor blades, we would advise that the ideas suggested are very clever indeed as far as the usefulness of the blade is concerned. The curved blades and holders are useful for many purposes which you have not mentioned. You have not, however, considered the cost of such. It is evident that blades of this nature could not be stropped with present day stroppers. The cost of grinding the edges is much greater than for straight blades now found on the market, and although a perfectly round blade would present better manufacturing possibilities, its area of effectiveness is very small, and it will only shave a thin strip down the sides of the face.

There is more information for you if you will write us giving your present whereabouts. Our letter to you was returned because you had moved and had left no forwarding address.

CAVEATS

(837) Tremont Thomas, Surprse, Neb., asks if he can protect an idea without disclosing it to anyone. He further wants to know if a caveat will do this.

A. Caveats are no longer procurable in the United States. A caveat was a very inadequate protection to the inventor; in it the inventor did not disclose his idea to the public, which a patent must do. Caveats entitled the inventor to notification of a rival invention, but did not directly protect. Part of the consideration for awarding a patent is the disclosure without reservation or concealment of the device.

Patents are issued so that anyone skilled in the art can make the devices, and the greater the number of claims, the broader and simpler those claims, and the clearer the description, the better is the inventor protected. Hiding things prohibits granting a patent to the inventor—a perfect legal disclosure is essential.

MANUFACTURING PROBLEM

(838) John Schultz, Washington, D. C., says that his patent attorney has advised him to proceed with manufacturing a toaster upon which he has applied for a patent.

A. 1. If your attorney told you that it was perfectly all right to make the toaster, you may rest assured that he had a reason for giving you that statement. He evidently knows that there is no patent that will infringe upon yours and consequently you are at liberty to manufacture the device.

If the Patent Office decided that there is an infringement, then they will not grant you a patent and the person who has invented a device upon which yours infringes cannot collect any money unless he presents suit against you for royalties. Inasmuch as the action may be dragged out in court for a period of two or three years, very few law suits are attempted, unless a guarantee of a large sum of money is forthcoming, or some revolutionary idea is at stake.

We advise you to follow your attorney's advice.

PATENT SALE

(839) L. S. Bryon, Chicago, Ill., asks for our advice as to the best procedure in bringing about and consummating the sale of a patent and its attendant rights.

A. 1. It is not necessary to present specifications and claims to a buyer of a patent, but it is advisable to do it, so that he knows exactly what he is purchasing. It is much better to work with the model as a first resort, and claim that a very basic patent has been allowed. After that the patent claims can be given to the purchaser.

A patent itself means nothing, but the model instantly conveys to the vast majority the idea of its practicability.

SILENT TYPEWRITER

(840) Clarence Albright, Chicago, Ill., suggests that typewriters be equipped with rubber pads just inside the ribbon so that the keys cannot strike the roller with force and thus the noise would be lessened.

A. 1. The rubber silencer on the ribbon side of a typewriter will not silence the keys without materially affecting the writing. It will be almost impossible to receive a perfect impression when a silencer of this type is used and consequently the typewriting will be very poor. We do not advise applying for a patent on this system.

AUTO HEATER

(841) C. A. Bukove, Therma, New Mexico, submits an idea for an automobile heater without details of the device's operation and asks for advice as to its patentability.

A. 1. With reference to your auto heater, we would suggest that you advise us how the same is operated, by means of electricity, exhaust heat, steam or any other form; also how the same is to be installed?

We cannot give any advice unless we have full information concerning the device in question.

RENEWABLE ERASER

(842) A. E. Kuhn, Tulsa, Okla., submits plans for a renewable eraser to be screwed into a pencil top. He asks our advice as to patenting it.

A. 1. The idea for an eraser to screw into the threaded top of a pencil is very old, and you will find that in many of the stores in New York extra erasers can be purchased to fit into the metallic end of pencils. It seems that very few know that separate erasers are supplied for pencils.

If you desire, however, you may have a search made upon this idea, and following said search you could probably have a patent taken out upon your system because you employ a new type of metallic shank which holds your eraser, which metallic shank is to be screwed on top of the pencil. In this way your device differs slightly from others we have seen. Nevertheless, the claims are not broad enough in our opinion to obtain any financial reimbursement for your device.

(Continued on page 712)

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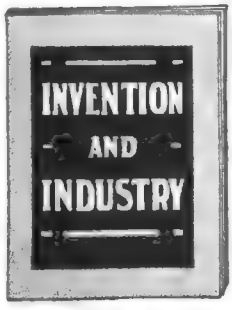

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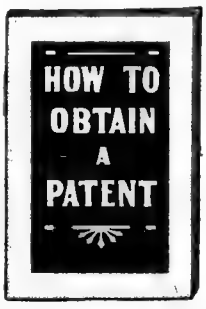

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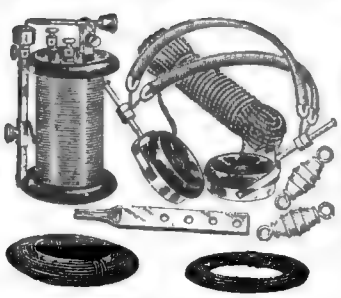

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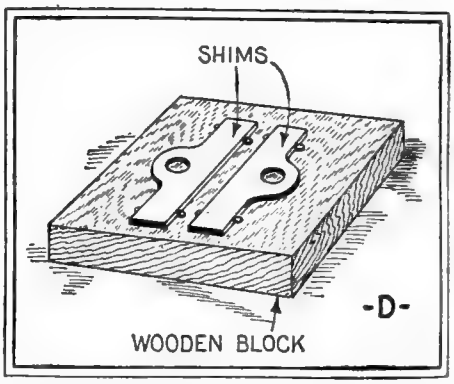
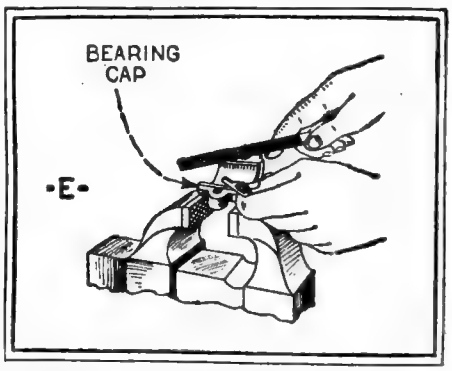
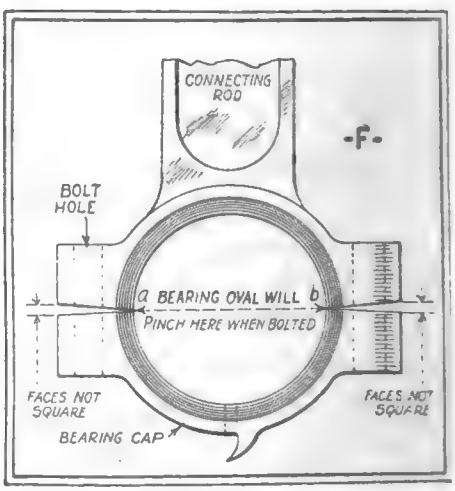


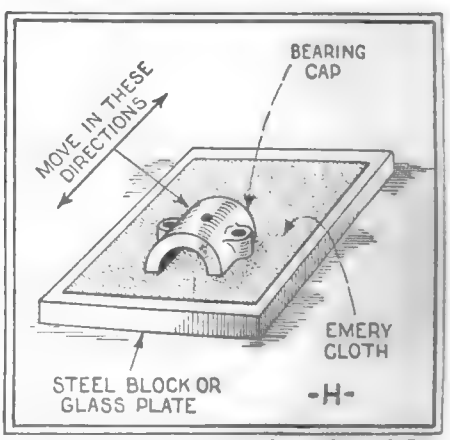
The shims should be placed on a flat block of some kind as shown in sketch "D" and the block held level in a vise. In this way it will insure the shim being the same thickness throughout its length after filing and will not cause the connecting rod to pinch in one place and give a wrong impression as to the amount of the bearing surface touching in the shaft, as in illustration F. The wooden block may be recessed or nails driven into it.



Sometimes it is necessary to file the bearing caps as shown in sketch E to absorb play.



File the faces of the cap level and true with each other, or else this condition may arise.



Emery cloth may be placed on piece of flat steel and cap moved back and forth.

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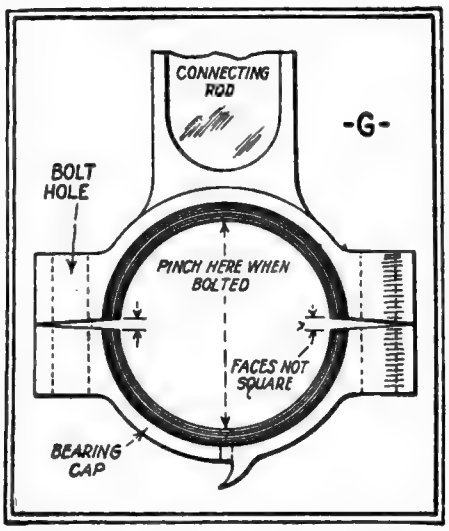
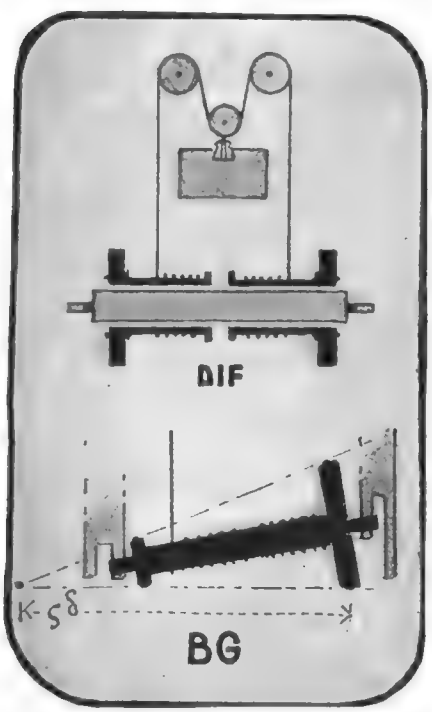


If the bearing is allowed to run in such condition as shown in sketch F and G, the bearing will soon wear and become noisy again.

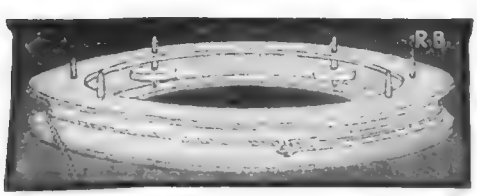
Hero's Automotor Dating 200 B. C.

(*Continued from page 662*)

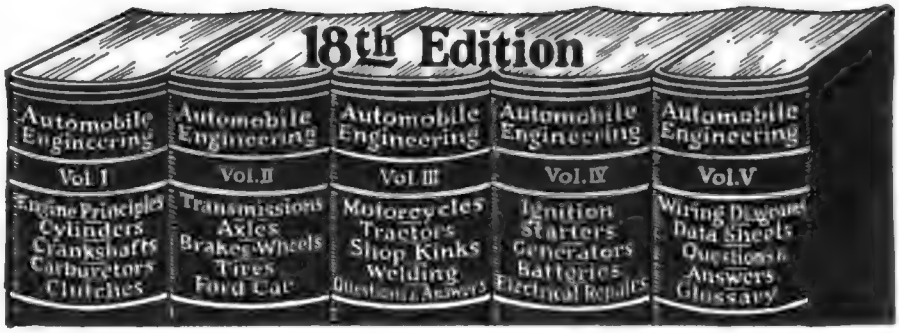
"RG" then to "RSB" turn the screws that cause steer wheel "BS" and bevel drive wheels "BG" to forcibly lower themselves below the "MD" wheels and its steer wheel. That operation makes the automaton do the



The picture above shows Hero's differential gear at "Dif" which works without a fixed radius, similar in principle to ours of today; while "BG" illustrates a fixed radius of the bevel gear.



This picture shows detail and close-up view of the roller bearing collar "RB," in which are placed six friction wheels as shown, these serving to spin the dancing girls as they circle the temple.



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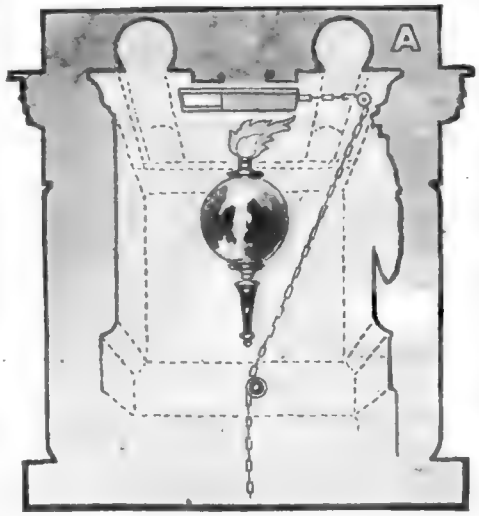

The detailed drawing "A" above shows how the altars were built on Hero's marvelous automaton. In these altars perfumed oil was burned under air compression, while the slide valve shown was operated by a chain.

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EDITED BY
LEON L. ADELMAN, 2AFS
Assoc. Mem. I. R. E.

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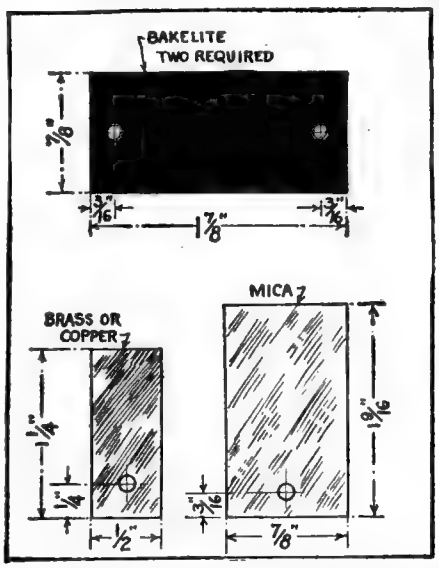

A very good and cheaply made condenser can be made from odds and ends found lying around almost anywhere. Two strips of hard rubber, bakelite, or other solid insulating material are used to clamp together strips of tinfoil which have been separated with small sheets of mica insulation. The capacity of such a fixed condenser varies as the pressure between the plates and also as the area of the plates. Of course, the thickness of the dielectric and the number of plates, must also be considered. —W. H. Goodson, Jr.

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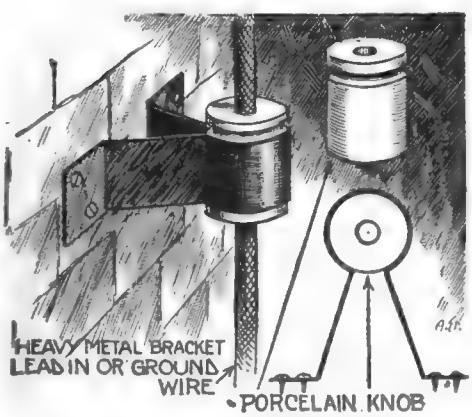

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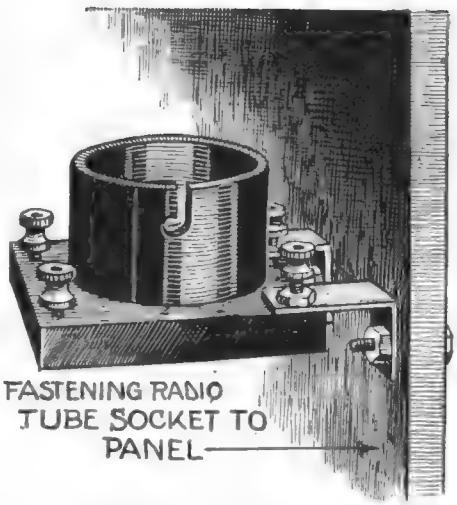

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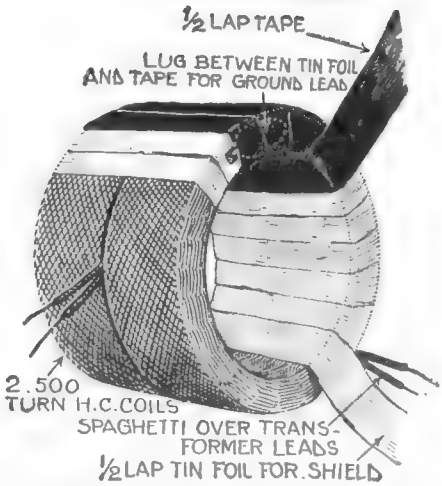
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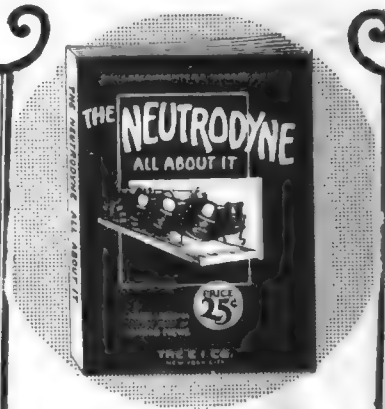

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Book Review

ACOUSTICS OF BUILDINGS. By F. R. Watson, Professor of Experimental Physics, University of Illinois. 156 pages, cloth. Published by John Wiley and Sons, New York. Price $3.00.

The importance of this volume may be aptly illustrated by the story concerning the building of a New York theatre. After spending well into the hundreds of thousands of dollars for the construction of this edifice, which was to be used as an opera house, it had to be discarded on account of its sour acoustics. It was found impossible for singers to do their best under the conditions imposed upon them by the mal-construction of the building.

The subject volume begins with some notes on the absorbtion, reflection and transmission of sound under various circumstances and as affected by various materials of building construction. The reader then plunges directly into the behavior of sound waves in a room and the question of acoustics with regard to the design of auditoriums. The problems of reverberation and echos are treated fairly, resonance and interference are also discussed by telling of the means of obtaining and combatting them, together with rules for their government. The effect of ventilation systems on acoustics is studied.

Then there are more or less highly technical chapters, dealing with special types of constructions, the sound-proofing of buildings, tables giving acoustic qualities of various materials and a complete discussion of ways and means of reducing the vibration of buildings to a minimum.

THE HOW AND WHY OF RADIO APPARATUS. By H. Winfield Secor. 160 pages, cloth. Published by the Experimenter Publishing Co., New York. Price $1.75.

After the BCL has outgrown his first flash of enthusiasm arising from his premier DX work, which he obtained without any knowledge of the apparatus, enabling him to annihilate space, he begins searching about for other means of excitement. He wants to know why the turning of the dial, the addition or subtraction of current, turns from a coil, the changing of the value of the condenser, should cause a different station to be heard in his telephone receivers. He wants to build a more complicated set, not merely to throw together a number of parts according to the instructions on the packing-box; he wants to design the set, build his own inductances or even try a circuit of his own. The success that crowns his efforts in such a case is entirely his own.

When the BCL reaches this stage he is an embryonic ham and his true scientific radio education begins. Then it is that "The How and Why of Radio Apparatus" comes in for a share of his attention. This book, aside from giving simplified but highly exact explanation of the phenomena underlying the operation of his set, gives as well the mathematics and calculations which govern their construction. This volume is probably the best elementary text on the science of radio easily within the reach of the young amateur. The chief value of this work is that the reader need not be equipped with a foundational scientific education in order to understand and put into practice the laws and calculations explained in it.

RADIO BROADCAST LISTENER'S BOOK OF INFORMATION AND LOG RECORD, by M. L. Muhleman. Illustrated, paper, 80 pages, 9½" x 5⅞", price 50c, published by the E. I. Company, New York City.

In this era of rapid progress, there are many little things that have long been wanted and still as yet have been undiscovered or undeveloped. Radio especially having partly succeeded in fulfilling one of these wants is gradually coming to the fore by numerous little additions and conveniences; among the latter a booklet may be counted. One which should not be overlooked is this little volume replete with information. Besides a well compiled and cross-indexed list of the radio broadcasting stations in this country, giving their power wave-length, frequency in kilocycles, time and hours of operation, the same stations are arranged alphabetically and also by states. Everything pertaining to the operation of a receiving set with numerous hints and wrinkles and clear cut drawings, depicting how to set up and operate a receiving set, are to be found in it. Tables giving vacuum tube data, international radio abbreviations, wireless code, graphs, kilocycle scale, applause cards, log-sheets and in fact, everything that could possibly be incorporated under the cover of a book of this nature have been included.

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Every channel for the speech currents must be kept electrically intact. The task is as endless as housekeeping. Inspection of apparatus, equipment and all parts of the plant is going on all the time. Wire chiefs at "test boards" locate trouble on the wires though miles away. Repairmen, the "trouble hunters," are at work constantly wherever they are needed in city streets, country roads or in the seldom-trodden trails of the wilderness.

Providing telephone service for this great nation is a huge undertaking. To keep this vast mechanism always electrically alive and dependable is the unending task of tens of thousands of skillful men and women in every state in the Union.

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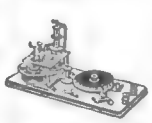

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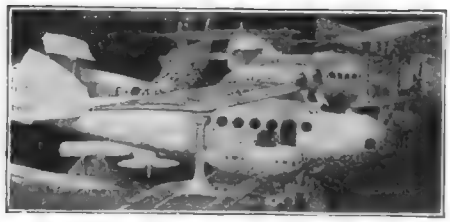

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HOW IS YOUR HEART? By S. Calvin Smith, M. D. Hard covers, 5¼" x 7¾", 208 pages. Published by Boni & Liveright, Inc., New York City. Price $1.75.

This is an interesting subject treated in an entertaining yet simple manner. It is surprising that heart disease, its treatment and cure, can be put in such terse sentences easily understood by the layman and just as easily applied by him. For the extremely busy man, the marginal paragraph keys are of great value. One need only read these heads, and then the particular paragraphs to which they apply. So well indexed is the work that it not only facilitates the location of those chapters dealing with the subject most needed at the time, but it also makes this work a standard reference book. The author evidently had the interest of his readers at heart when he wrote it, and recognized that those readers would be the lay public who know nothing at all of the subject. Beginning with heart diseases in grandmother's day. Dr. Smith passes on to the present day conceptions of the disease. He tells us of the reasons for fatalism, and warns us that the causes of heart failure need no longer prevail. He then describes the heart in action and shows how the heart is hurt and what the symptoms of heart disease are. He shows the relation between faulty habits and use and disuse of exercise; worry, dreads, fears, loneliness, unsound sleep, and diseases of all kinds, and the heart beat. He shows how the teeth can affect the heart. The author then explains the functions of the tonsils, and how if they are diseased, they change the heart beat. He describes murmurs and leaking valves and tells how the conditions can be corrected. There is a very interesting paragraph on advancing signs suggestive of heart involvement, and then a worthwhile treatise on the treatment of heart diseases after the onslaught of the disease has been well confirmed. This is concluded by a chapter on exercises for heart patients and occupations for them. A summary in seven comprehensive sentences ends the work. We commend it to any of our readers.

THE ESSENTIALS OF TRANSFORMER PRACTICE. By Emerson G. Reed. Hard covers, 5½" x 8", fully illustrated. Published by D. Van Nostrand Co., New York City. Price $3.00.

When we have an electric power line working at 220 kilo-volts potential, and more impending, it seems as if corona discharge, for the present at least, was the principal limit to our voltages. Transformer practice is now one of the most important subjects in electrical engineering. The great electric companies, such as the Westinghouse and General Electric, cannot turn out transformers by any haphazard methods. They have to be most accurately worked out in all their detail. One of the great electric supply companies has installed in Chicago a million volt testing laboratory rivaling the famous Pittsfield million volt installation, and it is here that we find the transformer used in its highest development, because such developments are measured by the voltage worked with. Vector diagrams are used and a quantity of formulas are given, and when along with the mathematical side where we find practical departments including the mechanical stresses, the care of insulating oils and the cost of operations, and other engineering subjects treated, we realize that the book will be thoroughly acceptable to electrical engineers.

GREAT INVENTIONS AND HOW THEY WERE INVENTED. By Charles R. Gibson, F.R.S.E. Hard covers, 5" x 8", with many illustrations, 240 pages. Published by J. B. Lippincott Co., Philadelphia, Pa.

This is a most enticing book for the rising generation. In old times the said generation did not have such interesting books as this to read in the line of science. Samuel Smiles in his book called "Self Help," while it is certainly very vivid with its descriptions of inventions and of episodes in inventors' lives must yield to this book in the personal interest, for the pages of "Great Inventions" are filled up with the personality of the inventors. It is interesting to read how Graham Bell was having his invention scored off the list at the Centennial Exposition in Philadelphia in 1876, and the day was saved apparently by the Emperor of Brazil. Listening as Graham Bell spoke into it, the Emperor exclaimed, "Good God, it speaks!" It is a pity almost that the author does not inform us of the very interesting fact that Graham Bell would not permit a telephone to be installed in his home.

THE CHEMICAL ELEMENTS. By F. H. Loring. Hard covers, 6" x 9", 171 pages. Published by E. P. Dutton & Co., New York City. Price $3.75.

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very difficult subject, if one wants to get at the basis of the world's material constituents. If one simply looks through the chapter in this book devoted to radio-activity or to another section where isotopes are treated on, the feeling will be that there is much to be learned, and a queer realization comes over the old-time chemist that perhaps one of the best things he could do would be to unlearn a lot. Where the work of one's life has been based on atomic weights, isotopic relations seem at first not to leave him a leg to stand on, and the only comfort is to use a colloquial expression and to be thankful that isotopes have not accomplished far more mischief than they have yet done, in disturbing our atomic weight relations.

RECENT DEVELOPMENTS IN ATOMIC THEORY. By Leo Graetz. Hard covers, 6" x 9", illustrated, 174 pages. Published by E. P. Dutton & Co., New York City. Price $3.50.

Heidelberg has given us an elaborate presentation of the Einstein theory, and in this work, Munich comes to the fore with a most valuable presentation on the subject of the structure of atoms. It seems almost a pity to find books written on this subject, because every day sees changes in theories, sees new developments, and the world is now eagerly awaiting the transformation of one form of matter into another at the hands of man. It has been pretty definitely determined that metals naturally change, stepping down stairs as it were, from radium and its neighbors down to lead. If man could direct the change and have it stop at gold, then we might say that the philosopher's stone had been found. Again as a possible source of power in the future, much is hoped for from the atom. We strongly recommend the book to our readers.

FROM IMMIGRANT TO INVENTOR. By Michael Pupin. Hard covers, 6" x 9", 936 pages. Published by Charles Scribner's Sons, New York City. Price $4.00.

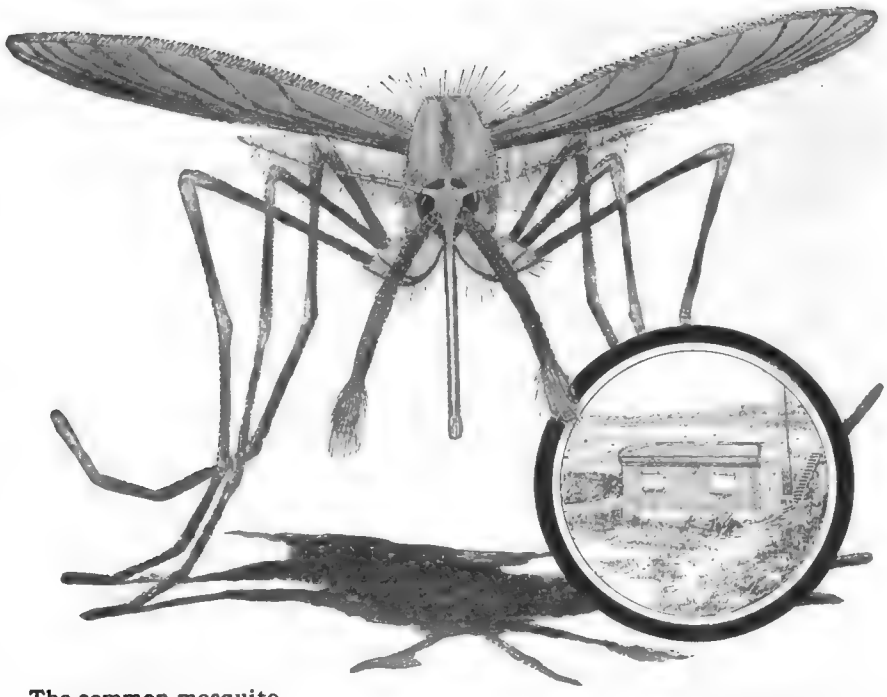
Professor Pupin stands at the very head of the electricians of America, and he has given us in this book a most interesting and vivid account of his life. One would be tempted to call it an adventuresome one, in the sense that he is so self-made, so self-educated, that his struggles from the bottom to the top are really intellectual adventures. It is interesting to read of President Barnard of Columbia College, handing the young scientist his diploma, for the old timers of Columbia are firm admirers of the old-time president who was a walking encyclopedia of knowledge. The illustrations are largely portraits of great scientists, and views of localities associated with Dr. Pupin. His work would be an inspiration to anyone, except for the fact that it makes one feel that he climbed a path so steep that few can follow it. From the literary standpoint the book is exceedingly good.

ECLIPSES OF THE SUN. By S. A. Mitchell. Hard covers, 6" x 9", fully illustrated, 425 pages. Published by Columbia University Press, New York City. Price $3.50 net.

The title of this book discloses what it is. It is devoted to eclipses, and tells of their appearances, of the outfits used for photographing them, and gives a popular cast by including scenery in the far distant localities where the observers had to take their instruments. So numerous are these illustrations, and so fully do they touch upon the different countries and inhabitants that they alone are a distinct feature of interest. Good as the text of the book is, and extensive as is the ground which it covers, the illustrations are so apposite and so explanatory, that it must have been a Herculean task to get them together. The author is a great admirer of Einstein and devotes a couple of chapters to his theory. The second of these Einstein chapters is entitled. "Has the Einstein Theory Been Completely Verified?" This is the last chapter, and the book, therefore, ends with a question.

THE ELEMENTARY PRINCIPLES OF LIGHTING AND PHOTOMETRY. By John W. T. Walsh. Hard covers, 5¾" x 9", completely illustrated, 220 pages. Published by E. P. Dutton and Co., New York City. Price $4.50.

Photometry of two or three decades ago amounted to the testing of lights upon the bar photometer. The Bunsen "Grease Spot," as it was familiarly called, or the Leeson Star Disk, was used as the screen to determine the position on the bar where an equal intensity of light was received from both sources, one the standard candle, the other the light to be measured. Today all is changed. The Lummer-Brodhun cube, a truly scientific production, has taken the place of the comparatively crude disks of old times. Again, instead of simply investigating the relative intensity of a standard candle and the lamp or light under investigation, the illumination received by surfaces is now studied. And the old time photometrists will be greatly interested in reading this book and will perhaps be surprised to realize how greatly the subject has been developed.



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Readers Forum

(*Continued from page 672*)

SCIENCE AND RELIGION

Editor, *Science and Invention:*

There have been ages when there was no real science, and also when there was no real religion.

Then, as the monotheistic religion of the Jewish people was being wrought out, the first beginnings of science sprouted among the early Greeks.

From those days through the ages up to the first streaks of the modern period, Science lived a most miserable and starved life, while religion grew strong and powerful, building wonderful temples and cathedrals, aggrandizing more and more extensive possessions, and coming into a temporal and political power that surpassed that of any secular potentate on earth.

In the last few hundred years of modern times, the universe, the world, nature, and man, have been increasingly unfolded to our gaze, and the world is gradually being understood and being controlled through the work of scientific research with its great strides.

What has been the result?

Science, through its marvelous discoveries and stupendous results with its nature-conquest, has won over the allegiance of millions of people who have thrown in their lot with her as being more useful to them than anything else.

The once scrawny and groveling followers of the scientific method became the all-possessing victors of the world, and were quick to consign religion to the humble bondage they had once been in.

In the turmoil, whirr and confusion, there were only a few who were able to see that there is a place in the world for both Religion and Science.

To Science is given the whole material world, and to Religion is given the world of soul, and spirit, and God.

REV. H. C. OFFERMAN,
New York City.

(Here is a bit of philosophy which one does not often find. Reverend Offerman has taken a very unbiased attitude toward science and has found that science does not conflict with the proper teaching of religion and neither does religion interfere with science in any way. More letters from gentlemen of the mental calibre of the Rev. Offerman would surely be appreciated by the editors and readers of this publication. A man can be a true scientist and a devout believer in religion at the same time. Of course we occasionally hear from a fanatic who will claim that the findings of science are erroneous because they conflict with a fanatical self-instructed form of religion, but the men who know religion as it should be known, the men who are in a position to instruct on religious topics and no such differences between the two subjects and are capable of studying both and molding their minds accordingly. We wish to publicly thank Rev. Offerman for his letter.—Editor.)

YOU ARE WELCOME!

Editor, *Science and Invention:*

It is with my thanks and appreciation that I acknowledge the receipt of your check for $10.00 in prize contest in your magazine "SCIENCE AND INVENTION" and beg to thank you very much for same.

In view of the fact that I am an inventor, I can readily appreciate the value of your wonderful magazine for the inspiration of others and the benefit of the development of science, and I shall be pleased at my earliest convenience to stop in and shake the hands of those who were so kind to acknowledge the value of my little invention.

WALTER H. SAMMONS
Philadelphia, Pa.

(Walter H. Sammons invented the comb and curling iron with the thermometers in the handles, so that the temperature of the iron or wave straightening comb can be determined. This was published in the August issue of SCIENCE AND INVENTION, *Latest Devices Page 352.—*EDITOR.)

HATFIELD'S RAIN MAKER

Editor, *Science and Invention:*

As the President of a fraternity of western farmers, I am appealing to you with the following proposition. At the beginning of this year the season was rather dry. Naturally when we needed the rainfall it was not present. Several of the farmers in the organization asked me to find out about Mr. Hatfield who claims to be able to produce rain when desired. Mr. Hatfield charges a rather stiff price for a certain amount of rain, but the price is low if his system will give results, and he advertises that we do not have to pay if the rain is not forthcoming within the desired length of time. Inasmuch as I know of no better authority to turn to than SCIENCE AND INVENTION Magazine, I am asking you to tell me what you

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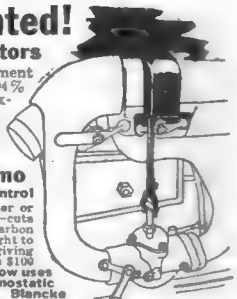

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know of this method of rain making. For obvious reasons, I must sign a fictitious name.

JOHN OSBORNE,
Hood River, Oregon.

(SCIENCE AND INVENTION *Magazine does not believe that there is anything practical in Mr. Hatfield's rain making system. Perhaps there is something behind his theory or secret which he has never divulged. It would seem from the towers that he erects, that he tries to precipitate the rainfall by chemical means, but practically his system is entirely inadequate. In this contention we are upheld by the Weather Bureau of the United States Department of Agriculture. Mr. H. B. Hersey, Meteorologist of the Agriculture Department, writes in part:*

" . . . As far as I can learn he (Hatfield) will never guarantee any rain whatever or post a forfeit to be paid in case no rain falls in the allotted time. He simply makes a contract to "produce" a certain amount of rain within a specified time and to be paid a certain amount of money in case the specified amount of rain falls. If the rain does not appear he gets no pay but—he does not lose anything except his time which is quite negligible.

"As far as I know his contracts always cover quite a period of time, usually several weeks or even months, and the amount of rain to be produced is no more than could be reasonably expected in that period. With that arrangement he should win in many cases and as he does not pay any forfeit for failure it is a case of 'heads I win, tails you lose.'

"He got a contract with some people up in the Fresno region last spring with quite a long period of time to 'produce' the rain. He got just enough rain to get inside the contract and got his money. At the same time other districts in southern California so far away that no one would connect him with it got considerably more rain than the region where he was 'working.'

"If he were able to produce rain at will out here even in the winter or so called rainy season he would not have to be looking for these jobs. The great electric power companies and large farmers and fruit growers would gladly pay him $100,000.00 a year to work for them, yes a million a year would readily be raised for him.

"But no man today can 'produce' rain. The forces of nature controlling the phenomena of rain and other storms are too vast and mighty to be controlled or led by man even with all his marvelous modern inventions and discoveries. Some day? Possibly, but it is not yet in sight.

"The Pueblo Indian had his society of 'rain makers' who were generally believed in. Other tribes, especially in semi-arid regions, have their special dances to evoke the favor of the 'Rain God' and produce the life giving fluid needed for their drought stricken crops. It is strange that the 'pale faces' have those among them who grasp at any straw which gives them hope of rain in this beautiful and wonderful country where water is really liquid gold!"

Another letter from Dr. C. F. Marvin, Chief of the Weather Bureau, of the U. S. Department of Agriculture, relating to Mr. Hatfield's rain making system, is quoted below:

"A great many schemes for the artificial production of rain have come to the attention of the Weather Bureau, but without exception they are utterly impracticable; this view is entertained, we believe, by all competent authorities, and is fully supported by calculations based on the known laws of physics and meteorology. No reputable scientist who is acquainted with the laws of evaporation and condensation and the amounts of energy involved in the production of rain pretends to offer any hope that rain can be artificially produced on any worthwhile scale under droughty conditions.

"Mr. Hatfield has never, so far as we know, divulged his secret, but we are morally certain, from our knowledge of how rain is produced in nature, that his scheme, whatever it may be, is utterly inadequate to produce the results he claims to have obtained. I wish to say emphatically that if any rain has fallen in a region in which, and at a time when, any so-called rainmaker has been conducting his operations, it is absolutely certain that the whole quantity of rain was the result entirely of natural and not artificial means. In all such cases, so far as examined and checked up, the rain was already 'on the map' and occurred wholly independently of anything done by the 'rainmaker.' it would have taken place just as it did had the operator been thousands of miles from the locality in question.

"We regard all artificial rainmaking schemes as utterly impracticable, and their advocates as, at best, misguided enthusiasts; and money expended in furthering such schemes is just that much money wasted and diverted from legitimate uses."
—Editor.)

Marconi, also, for the past several years, has been laboriously at work and now announces the perfection of a system of directive radio communication. Under exacting tests, the beam of radio waves, was successfully received at a distance of over 5,000 miles, between London and Buenos Aires.

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Thousands earning $2,500 to $10,000 a year in easy interesting work. You can do it! Let me prove it. By E. R. HAAS, Director, National Radio Institute.

Earns College Education
I entered the maritime service of the Radio Corporation of America and served several months on board ship. I not only had the advantages of visiting foreign countries at no cost to me but I was also able to save enough money to pay for my tuition to college. **G. E. Rogers, Troy, N. Y.**

Earns $50 to $83 a Week
I enjoyed every one of your lessons and had no trouble whatever. I earn $50 to $83 a week beside a commission on sales. **Michael De Marco, Boston, Mass.**

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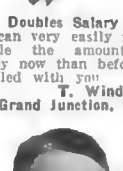
I can very easily make double the amount of money now than before I enrolled with you. **T. Winder, Grand Junction, Colo.**



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I am averaging anywhere from $75 to $150 a month more than I was making before enrolling with you. I would not consider $10,000 too much for the course. **A. N. Long, Greensburg, Pa.**

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I cleared up $405 in one month recently. Not so bad—is it—for a fellow who just completed your course a short time ago. **Emmet Welch, Peculiar, Mo.**

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I am earning three times as much as before enrolling. **Arthur Herke, Vancouver, B., C.**

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Before I enrolled I was making $15 a week. Now, I earn from $2,080 to $1,420 a year. I believe the course will be worth at least $100,000 to me **George A. Adams, Tamaqua, Pa.**

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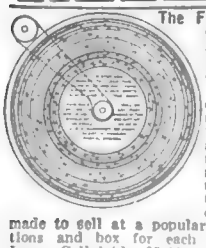

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The Living Death

By JOHN MARTIN LEAHY

(*Continued from page* 659)

the place where they died; for they could not have lived in such a temperature. It was, therefore, at the same instant when these animals perished that the country they inhabited was rendered glacial. These events must have been sudden, instantaneous, and without any gradation.'"

"How," asked Frontenac, "could any such cold have fallen suddenly, instantaneously?"

"I don't know," replied Livingstone. "I believe I can prove that it came in an instant, however."

THE JOURNEY

"And so I return to my story. I organized my expedition, and at last the *Multnomah*—that is the name of my schooner—cleared Tatoosh and stood away on her course.

"After an uneventful passage—we entered the pack just east of Circle Island and in latitude 58° 15′ S. You will see from this that I was indeed headed for the Unknown.

"There is another great Unknown, stretching from Ross Sea eastward to Palmer Land; but had I chosen a base there in moving Poleward, I would have been *converging* toward the route of Shackleton and Scott and that of Amundsen, whereas it was my intention to explore from a point as nearly opposite as possible. In other words, if I could reach the Pole itself, a trail would be blazed clear across the Antarctic Continent!

"Such, I confess, was my ambition. You will soon see what came of it.

"Finally, after twenty-two days in the ice, land was sighted in latitude 76—land (so we thought then) never seen by human eyes before.

"For six days we coasted along it, kept away from the land by the great barrier and held up half the time by floes. Then, on the seventh day, what appeared to be an entrance opened up to the south, and we stood for it.

"An entrance it proved to be, and pretty well jammed with ice driven down by the northeast breeze. Twice we were held up, and once I thought the *Multnomah* was in for a good squeeze. I never saw ice close so suddenly as it did. It was fifteen to twenty feet high in places. But there is no accounting for the movements of ice in those seas. Without any cause whatever, so far as we could see, a lead opened up, and we got through.

"And now I come to the first of our surprises.

"We had soon left the ice behind us. The *Multnomah* was moving through water as clear of ice as the Sound out there. I began to look about me with something like astonishment.

"The temperature of the water, we now found, had suddenly risen from 31° to 39° Fahrenheit. That of the air had not changed, it was still 28° below zero.

"On either side, rose high rounded hills, covered with snow, dark volcanic rocks showing through here and there. These hills were closing in before us, and I thought our way was barred. But such was not the case. The passage, now a narrow one, took a sharp turn to the right. And there, in the midst of it, appeared an island, rising up like a great ruined castle.

STRANGE THINGS

"The channel to the right was the larger, and we took it. It was, however, no more than three hundred feet in width. Soundings gave bottom at six fathoms.

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"It now seemed that we *were* nearing the end—that the channel terminated half a mile beyond Castle, as I named the island.

"But wrong again! It was not the end but another turn, this time sharp to the left, or to the southward. Again we had deep water. No bottom with fifty fathoms out. The channel was gradually widening.

"The *Multnomah* stood steadily on, the chug of her engines echoing and re-echoing weirdly from the hills. There was not a particle of ice in the water; ice and snow, though, covered the hills, coming down to the water's edge. As I have mentioned, however, here and there dark volcanic rocks showed through.

"Again the *Multnomah* came to a turn, a gentle turn to the left, and in a few minutes we were gliding out into a large bay, expanding to some three miles and stretching away to the southward as far as we could see. A thin mist arose from the water and hung low over it as it moved before the wind—in appearance, very much like frost-smoke.

"High rounded hills rose on either side, and, to the southward, a jagged range of mountains was dimly visible, trending away in to the interior as far as the eye could reach. And further on, their bases touching, two great rounded peaks rose up.

"The one on the left I named Mount Theodore Roosevelt, that on the right Mount Woodrow Wilson.

"The *Multnomah* stood on, bays and inlets opening as we advanced. Still not a particle of ice was anywhere to be seen on that wonderful sheet of water — which I named Summer Haven. Evidently no glacier debouched into it. And this, as we afterwards found, was the case. The great glaciers of Mount Theodore Roosevelt and Mount Woodrow Wilson go westward to the sea—a range of hills rising between those mountains and Summer Haven.

"But how to explain this strange scene about us? Here, in this terrible ice-bound coast, in the midst of hills covered with snow and ice, was a sheet of water miles in extent and not a particle of ice to be found floating anywhere on its surface!

"Another thermometer reading was taken. Temperature at surface of water 44°—a rise of thirteen degrees. Temperature of air the same—minus 28°.

"I was, however, already suspecting the truth.

"And then we opened a view behind a bluff-like hill, and a few minutes afterwards a white column—a half mile from the shore, as we subsequently learned, and two miles distant—was seen to suddenly shoot into the air, the steam from it ascending to a height of two thousand feet or more!"

The captain looked at us inquiringly.

"You know, I suppose, what that was, gentlemen?"

"Geyser," said Darwin Frontenac.

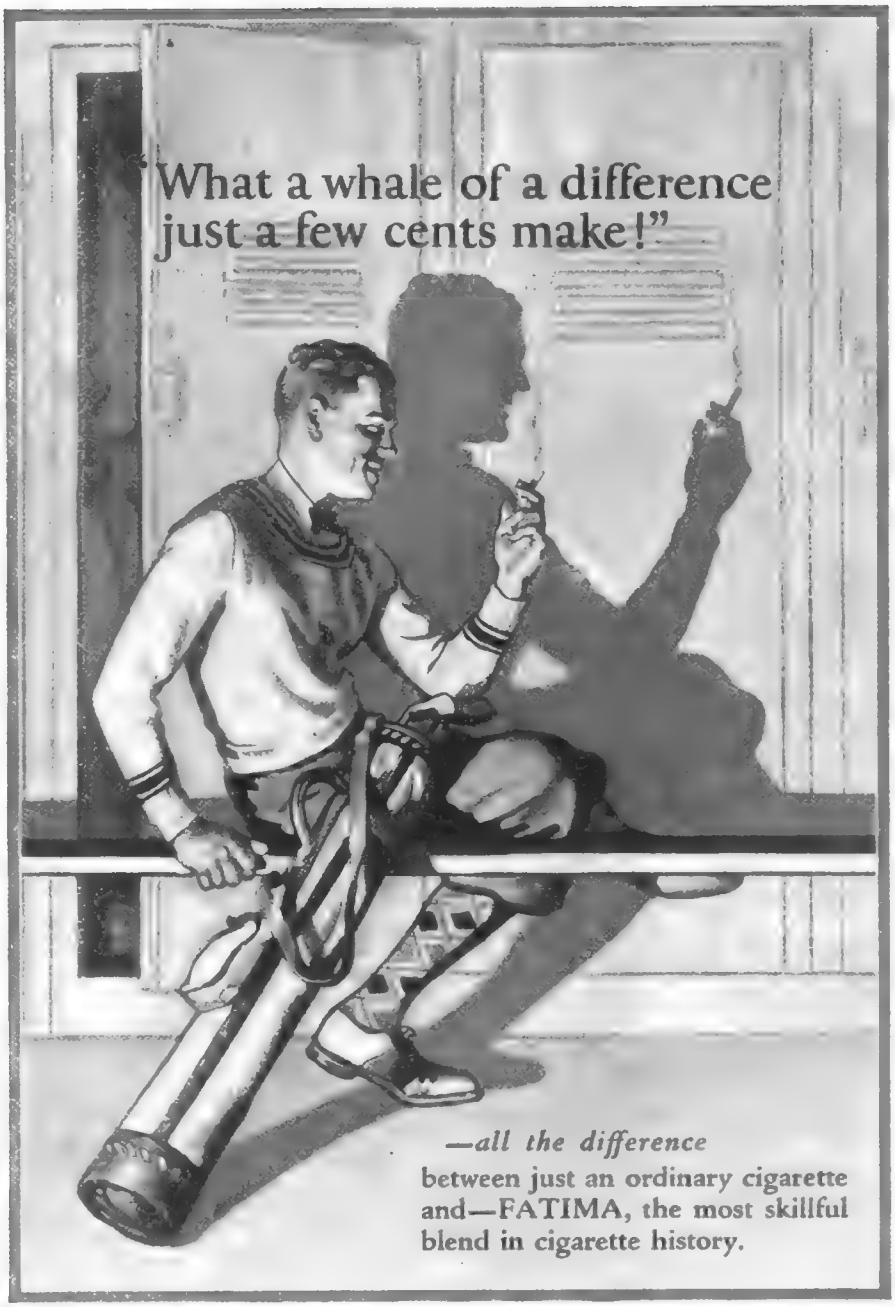
"Just so; the largest geyser in the world, as it proved. It erupts every seventy minutes, sends its columns of boiling water to a height of over four hundred feet and plays for twenty-five minutes. I called it Hero's Fountain.

"But Hero's Fountain is not the only one. In short, we had discovered another Yellowstone—though this Yellowstone of ours was by far the most wonderful.

"Fortune had smiled upon us—though, as you will see, discoveries more wonderful were to follow.

OTHER'S WORK

"But we had done very well, even if this were all. Wilkes had discovered that land of continental proportions exist in the Antarctic; Ross had discovered the sea that bears his name and, a discovery more interesting than that, the volcano Erebus; Nordenskjold had found fossils that proved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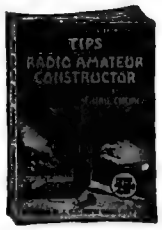

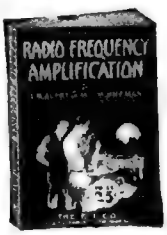

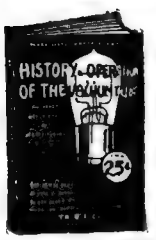

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this terrible land had once been clothed in luxuriant vegetation; Shackleton had found coal; Scott, copper in workable quantity; and now here was this discovery of ours.

"Here were all the secondary volcanic phenomena, as I believe the scientists call them—hot springs, fumaroles, solfataras, mud-volcanoes and geysers!

"The warmth of the water was now explained: they owed that warmth to volcanic fires somewhere below. The high temperature—it was found to be 51° near the end of the Haven—was, however, in no small measure due to the narrow and comparative shallowness of the entrance, to which I gave the name Multnomah Pass. Much of the heat was, of course, lost by radiation. Had the entrance been wide and deep a different story would be told. For the cold water, in large quantities, would have been continuously replacing the warm, while, as it was, the cold water from the sea could get in only very slowly as the warm flowed out through Multnomah Pass, and that narrow channel allowed small escape.

"A great change was now made in the expedition's plans. After landing the dogs and stores, the erection of the hut and so on, the *Multnomah*, according to these plans, was to make her way back through the pack and come again for us the next summer. But all that was changed. She would winter here in Summer Haven. There were no icebergs to go ploughing with the wind. The wildest gale could never send floe or berg in through Multnomah Pass."

"Was any vegetation found?" asked Frontenac, for the captain had paused.

"Moss, some pretty moss-flowers and a few shrubs, and that was all."

"Ah," I said to myself, "no palm-trees yet!"

"Of course," the discoverer went on, "I did not have any illusions. I felt sure that the bitterest cold of the bitter Antarctic could never freeze this haven over. But I well knew that everything else would be frozen. There could be no appreciable atmospheric warmth. The winds would carry all that away. Even in still weather, it would be the same thing. For there would be a steady indraught of cold air from the frozen waste.

CHAPTER VI

The Second Discovery

"Now for the palm-trees!" I thought.

And I was right, though it did not come at once.

But he had made even more strange discoveries. Imagine a sleeper in a bed of crystal, his poor wondrous Sleeping Beauty; there in that dreamless, awful slumber, a slumber terrible as death, unbroken through centuries unnumbered, through ages even, ages unrecorded; a sleep never to be broken until that day of doom for all things earthly or until the foulest of deaths of which the captain had spoken overtook her unless, as in the fairy tale, there came a prince to awake her!

But I anticipate.

After a slight pause, Livingstone went on with his story:

"For a time we were very busy. There was much to be done, much to explore, depots to be laid down, before the long Antarctic night closed in on us.

"And how much different things were to be than we had planned—here in this wondrous spot! The erection of the hut was begun at once.

"Of course, in one way, our work, thanks to our discovery of Summer Haven, was considerably shortened: there was no need to land all the stores at once, as otherwise would have been the case.

"After our exploration of the region round-about, I turned to the southward. We

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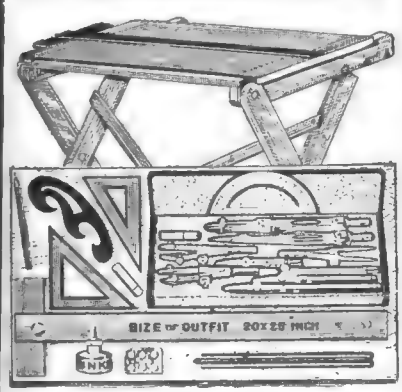

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passed the rising land between Summer Haven and Mounts Roosevelt and Wilson, passed between those mighty peaks and out upon the great glacier beyond. This glacier, which I named Washington Glacier, was to be seen stretching for mile after mile to the southward.

"There lies our way to the Pole—for a long distance at any rate,' I said.

"Little did I dream that this terrible highway of ice was to direct us to something far more wonderful than the Pole!

"I now turned back and ascended the side of Mount Woodrow Wilson to reconnoiter the country. Up we went until our aneroid told us we stood five thousand feet above sea level. From the mountain-top we could trace the glacier much further, and it ran on as wide as ever. The ranges of mountains that flanked it on either side continued for a hundred miles or more.

"Three days later, we set forth from Summer Haven. We made our way up the glacier for some seventy miles and laid down our first depot in latitude 78° 50′; the hut, near the southern extremity of Summer Haven, was in latitude 77° 45′. In getting those seventy-five miles of southing, our sled-meters logged eighty-four miles, so you see we had been going pretty straight all the time.

THE SECOND STOP

"Again we went southward, with supplies for our second depot. I determined to push on as far as possible. Ten miles or so beyond Depot One, however, we got into a crevassed and pressure-twisted region which slowed our progress. We got through with much trouble and labor, came to the end of the glacier, ascended to a broken plateau and at last reached latitude 80° 15′—one hundred and seventy miles from Summer Haven. With this we stopped and we had cause for satisfaction.

"You shall have details, if, when you have heard my story, you decided to go and see for yourself."

He smiled at us a little bitterly and with a strange sadness.

"Heaven knows, I should not blame you if you think it was all a dream.

"So we had laid down number two in latitude 80° 15′. Once more, though the season was getting late, we went south; this time we pushed on to latitude 82° 10′, where we put down the third depot. This ended our southern work for that year.

"The sun left us on the 25th of April, and we did not see it again until August the 18th.

"There is no need to dwell on that long Antarctic night. Let us hasten on to the southern journey in the spring.

"We got away on the first of November—myself and four men. November 15 found us at depot three. Before us now lay the unknown—tumbled, shaggy mountains on every side, five hundred miles between us and the Pole.

"To get through, we had to swing off to the left. After a terrible time among glaciers, we made the passage of the mountains and entered a great snowy plain. Here at times for miles the surface was as smooth as a lawn, and then the dogs—there were four sleds and sixty dogs—went on at a spanking rate. Then again we would of a sudden find ourselves in the terrible sastrugi, and the going was such as to make a bishop swear.

"At latitude 85° we laid down depot five and made our second discovery. This discovery we owe to the geologizing fever of Hampden. I should have explained that we had left the great plain behind us and were once more in the midst of mountains. In the spot where we had fixed upon for the depot, the mountains rose up no more than a mile away on either hand, and the steep

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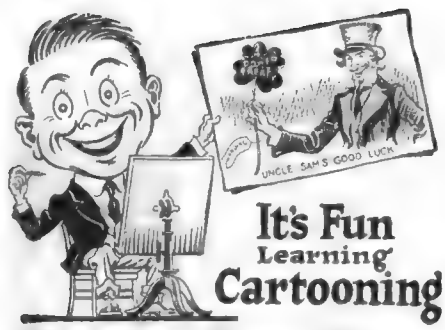

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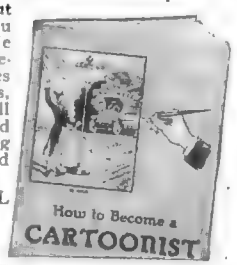

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"I thought of Amundsen's surprise at seeing two of these birds (on the opposite side of the Pole) in latitude 84°, and of the one seen by Scott in latitude 87°, and I confess that my surprise became greater than ever.

"But the gulls were not the only thing we found ourselves unable to account for: the dogs could be seen gazing away to the eastward, up at those mountains, as if some sudden and strange message, one not fully understood, as it were, had been borne to their acute senses. They would erect their ears, their eyes would shine brightly and eagerly. They thrust up their muzzles to sniff the air.

"'What the devil,' said Thompson, gazing up at the mountains and actually beginning to sniff the air himself.

"This was after we had made camp. The nearest dog arose at the sound of Thompson's voice, whined in a strange manner, then came over to Thompson, squatted at his feet and once more turned his eyes to the eastward and once more began his mysterious sniffing.

"'Something there,' said Thompson, waving a hand up toward the heights. 'Something queer or the dogs wouldn't be acting like this.'

THE NEXT DAY

"We were off early the next morning, and in a few minutes had begun our ascent. It was very difficult work. But we toiled steadily. We arrived on a wide ledge which ran off to the left, towards what appeared to be the entrance to a gap through the range. That it was a gap seemed plain enough from below; as to how far it extended back into the mountains we had had no means of knowing—unless we had gone forward to reconnoiter. I had felt so confident, however, of getting through this way, that this had not been done. I know it should have been done, but it wasn't.

"There is nothing so trying as suspense. And I confess I began to worry. Perhaps, after all, we should not have trusted to chance.

"Two hours of hard work brought us to the mouth. And, now that we were there, we started and didn't know what to make of it.

"'By the great Hercules,' said Thompson, 'it doesn't go clear through! Look how the walls come together and how the peaks on either side end by hugging each other.'

"Thompson, indeed, had given no bad description of the prospect.

"At this instant, however, one of the dogs broke into sharp whining. His look I found fixed, it seemed, high up on the rocky mass on our right.

"Before I could turn my look up there, Hampden cried out:

"'Oh, Lord, look at *that!*'

"I am afraid that, as I looked up, I exclaimed and took a step or two backward and crouched as though to shield myself. There was something driving down out of the heavens and directly toward us. At that moment, my startled senses could not give the object its true size or shape; it seemed of monstrous size, and certainly it was driving down upon us with the speed of an arrow. *It dropped.*

"Had one of those winged devils in Doré's pictures for Dante's Inferno launched himself down at us in this fashion from off that icy cliff, the sight of him could scarcely have been more startling and astonishing.

THE BIRD

"The apparition was so sudden and unexpected—no wonder our senses played us tricks; no wonder they magnified, distorted; no wonder they made the thing monstrous. Suddenly a great pinion shot out from either side of the driving object, and the next moment, with a dull rustling that was

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like a roar, a great bird went rushing past, barely twenty feet above our heads.

"It fetched up on the instant, came circling back and began to wheel round and round above us.

"'Look out!' cried Bogardus. 'He's going to drop again!'

"So, indeed, it seemed. And I could have sworn that the thing had his eyes fixed on me.

"Thompson had rushed to his sled to get a rifle, Hampden to his sled to get the other. Save for our knives and axes, these two rifles were the only weapons that we had. In all likelihood, if we had taken along more weapons, my story would have been very different.

"But thus it was that those poor loyal comrades of mine were doomed men—doomed to the horror in the palm-trees.

"Only two rifles! And we were soon to find ourselves in a place where a dozen would have been none too many!

"I thought the bird was going to drop upon me. This might have been only fancy on my part, but certainly his looks were anything but benevolent. But he changed his mind and began to rise.

"Thompson fired and missed. Miss again. Thompson flung forth a savage oath and clicked another cartridge into the chamber. The bullet went straight to the mark this time, and down the great bird tumbled into the snow.

"I was the first to reach it, and it struck savagely at me with a vicious beak. The next moment, however, it sank inert, and in a few seconds the strange creature was dead.

"Its wing spread was found to be eight feet; it was of a brown color; and, under each wing—mark this well—there was a white line!"

The explorer look at us with an expression I did not understand.

"Perhaps you wonder why I lay so much stress on that white line under the wings."

"That," Frontenac told him, "is just what I was wondering."

Captain Livingstone drew forth a pocketbook, opened it and took out a sheet of note paper.

"This," said he, reaching the paper to Frontenac, "is from Shackleton's *The Heart of the Antarctic*. Read it, I think it will show why."

Frontenac already was reading. On looking up, as he finished, he said:

"Strange! Very strange!"

And that was all that he said. But it was quite enough to show that Darwin Frontenac had been greatly impressed.

A QUOTATION

Without a word he handed the paper over to me. This is what I read, Shackleton's entry being for December the 5th:

"I was still badly snow-blind, so stayed in camp whilst Marshall and Adams went on to spy out a good route to follow after lunch was over. . . . The most remarkable thing they reported was that as they were walking along a bird, brown in color with a white line under each wing, flew just over their heads and disappeared to the south. It is, indeed, strange to hear of such an incident in latitude 83° 40′ South. They were sure it was not a skua gull, which is the only bird I could think of that would venture down here. . . ."

I confess I was puzzled not a little.

"It is true, as I afterwards learned, Shackleton (unless I misread him) thought the bird was really a skua gull. I think it extremely unlikely, however, that the men who saw the creature could have been deceived, especially when it passed 'just over their heads.' Supposing the bird Marshall and Adams believed was a strange one really was a skua, is the mystery any the less a mystery? The fact remains that the bird was traveling toward the Pole!

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"Shackleton thought the incident a strange one; but, as to the strangest thing of all about it, he makes no comment whatever. Not a single word elicited by the mysterious fact that the bird was flying south!

"Then there is the skua Scott saw in latitude 87°. Scott doesn't even tell us what direction the bird took. In fact, he thought it was merely following his party.

"Amundsen was the only one who was truly impressed by this mysterious flight. Here is what he says."

The captain handed another paper to Frontenac, who, in turn, passed it on to me. The note was copied from Amundsen's *The South Pole.*

"As we were leaving this old friend [the beacon in latitude 84° 26'] and setting our course as it advised, to our unspeakable astonishment two great birds—skua gulls—suddenly came flying straight towards us. They circled round us once or twice and then settled on the beacon. Can anyone who reads these lines form an idea of the effect this had upon us? It is hardly likely. They brought us a message from the living world into this realm of death—a message of all that was dear to us. I think the same thoughts filled us all. They did not allow themselves a long rest, these first messengers from another world; they sat still a while, no doubt wondering who we were, then rose aloft and flew on to the south. Mysterious creatures! they were now exactly half-way between Framheim and the Pole, and yet they were going farther inland. Were they going over to the other side?"

"Well," the captain said when I had returned the paper to him, "that was where we were—on the other side. And I believe it was toward this very region that those skua gulls of Amundsen's and that strange bird seen by Shackleton's men were flying. Where could those creatures have been going if it wasn't toward the place there beyond the mountains?

THE PASS

"We had, all things considered, done a good day's work; but we pushed on for two miles more before we camped. It was bitterly cold, the temperature having fallen to 22° below zero. Also there was the heavy dampness in the air which made the frost even more bitter.

"The walls had closed in on us, their bases at this place being separated only five hundred feet. What was there before us? Certainly the eyes could give but little certain information in answer to that. Well, we should learn on the morrow. And certainly, too, the surface here was extremely difficult to pass. That night we were awakened more than once by the booming of the glacier. The sound was a deep, unearthly thing, and, until one became accustomed to it, it gave one a shiver. Something of the kind, however, we had heard on some of the other glaciers.

"Once, too, that night the dogs set up a sudden, fierce whining and howling that brought all of us out of our sleeping-bags into the bitter outside air. The dogs kept looking up the chasm, but we could discover nothing. Thompson declared he saw something black and without any particular shape, move up in the cut but the others thought he must have been deceived.

"I use the word night, but, of course, that word is not, strictly speaking, applicable. For here, though hidden by the moutains, the sun never set. The place in which we were camped was in deep shadow, gloom even, but the sunlight shone cold and bright on the mighty mountain masses above us.

"We were up early. It was still bitterly cold. I thought of going forward first to see for certain what was ahead, instead of thus blindly moving on with the dogs and sleds; but at last decided to push on without further investigation. For some time,

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almost three hours, the going was terrible. We were rising steadily, and the walls were now only two hundred feet or so apart. The rock masses, towering before us higher and higher, were almost free of snow. They were masses black and terrible.

"We were, indeed, making our way into one of the most remarkable passes in all the world. It was, as Thompson remarked, as if some cosmic giant had driven a wedge into the rocks and split them asunder.

"It was a little after three o'clock when we passed the highest point, eight thousand four hundred feet. The end of the day's march, however, found those great walls still towering above us. We had descended near a thousand feet, though, and had great hopes for the morrow.

THE JOURNEY CONTINUES

"If we had only known what was before us!

"The actions of the dogs were now a greater puzzle than ever. They sniffed the air constantly and gazed down the chasm. We had much discussion and speculation.

"We were to learn, and soon at that.

"I roused the party a little after five and by seven o'clock we were pushing on once more. This, the great day, was the eleventh of December. Despite the hard work of the last few days, both men and dogs were in fine fettle, and, when the surfaces would permit, we went along at a swinging gait.

"This, unfortunately, was not often or for any great stretch; as a whole, the surface of the glacier continued miserable for travel. It grew worse as the descent grew steeper. Consequently the crevasses and pressure-waves and ridges gave us more trouble. The only consolation was that we were going down hill.

"Another difference we noticed, though at the time I thought nothing of it, for atmospheric changes are anything but unusual in that strange land.

"For some days the air had been clear, so clear that it seemed to sparkle like wine. But a curious haze was over everything now. It seemed to lift or move aside at times, then suddenly it would close in again. These movements produced changes in the appearance of objects that were simply astonishing. One minute a mountain pass would have a certain form, and then, perhaps five minutes later, one could scarcely believe that he was looking at the same object.

"This haze became thicker as we advanced. Indeed, ere long the eye could no longer, save for fleeting moments, make out those heights on either hand, though the chasm walls had now sunk to a comparatively low altitude.

"Height of noon camp five thousand feet. Haze thicker and more tricky than ever. Thermometer had risen to minus 2° Fahrenheit. We pushed on eagerly, wishing the haze would lift. But the haze did not lift. Instead, we suddenly plunged, as it were, into a dense fog. We could not see a hundred feet ahead. Had Scylla and Charybdis or ten thousand Cyclops been lying in wait we would have been none the wiser. Yet move on we must, and move on we did, literally feeling every foot of the way.

"Those were terrible hours that followed. There is no need, however, to dwell on them. I shall leave that to the imagination. It was trying, dangerous business, this groping forward—blindfolded, as it were—into the unknown. But I was determined to keep at the journey until something brought us to an utter standstill, for, if we stopped and waited for the fog to lift, we might have had to stay there for days.

"At length we suddenly became aware that sounds no longer came back in echoes. What had become of the chasm walls? Had

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we at last issued from that great cañon. Where were we?

EXPLORATIONS

"Thompson went off to the right, Hampden to the left. The aneroid gave us an altitude of four thousand two hundred feet. Since the noon halt, we had descended nearly a thousand feet. The temperature had risen to 6° Fahrenheit. At last, in about twenty minutes, Thompson returned. Nothing, he reported, but snow and ice and fog in that direction. A few minutes, and Hampden came back with the report that he had bumped into a granite wall.

"So on we went once more. I was forerunner—foregroper, rather, for that was what I was doing. Suddenly the fog thinned. I thought I even caught a glimpse of blue sky. Then the vapor closed in once more, denser it seemed than ever. Five minutes, and again the fog thinned out. This time there was no mistake: I did catch a glimpse of blue sky. But almost instantaneously the blue was blotted out, and once more I was groping my way on through gray darkness.

"How long it was I do not know. Perhaps it was no more than five minutes; perhaps twenty. Suddenly, however, the fog thinned, and the next moment I stepped out of it, as through a curtain, and stood in bright sunshine. Before my eyes a view the like of which no discoverer ever set eyes upon, greeted me.

"I am not, I believe, in any sense of the word, nervous or excitable. But it was all I could do to keep from crying out at what I saw. The next moment, however, a thought came that sobered me, at the same time filling my mind with a doubt that was simply terrible. Was it all only a mirage or a dream?

"So I said nothing, just stood there and gazed and waited for the others to come.

"Hampden was the first. As he stepped out into the sunlight and saw it, he started, fetched up and stared like a man transported to a sight of fairyland. Then he gave a loud shout or cry—I don't know which it was, perhaps it was both—that brought the others to our sides as fast as they could come.

(To be continued next month)

Everyday Chemistry Answers

By RAYMOND B. WAILES

(*Continued from page 675*)

1. ALMOST! Glucose is now being made by heating starch with a trifling amount of acid. Ironing gives the heat and if the starch is sour approaches this sugar transformation and it is possible that sugar may be formed in ironing.

2. One of the most popular and widely advertised gasoline treaters consists of a mixture of nitrobenzene (oil of mirbane) and coal tar naphtha. Kerosene or creosote oil is sometimes used instead of the naphtha. The carbon deposits in the cylinders are supposed to be removed by the nitrobenzene. Aniline is also used.

3. Usually, coal which produces red or brown ashes will clinker more readily than will the coal which produces white ashes. The brown or red color is due to iron and the white color is due to alumina (aluminum oxide) which melts at a much higher temperature than the iron or red ashes.

4. No, water glass is not an adulterant. It actually helps laundry soaps to perform their detergent duties. Many soap makers caution against laundry soaps which contain water glass to boost their own product.

5. A near arsenic famine threatens to limit agricultural growth which is promoted

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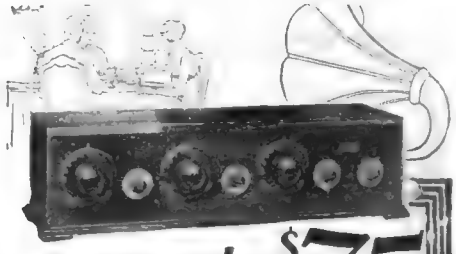

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by Paris green, a compound including copper, vinegar and arsenic and which is used as an insecticide. Copper carbonate or copper "rust" which is frequently seen on copper lightning rods, gutter spouts, etc., bids fair to replace Paris green.

6. Fanatics say deadly carbon monoxide gas is present in tobacco smoke. Less than .01 per cent. of carbon monoxide gas was found in the air in a room in which there was so much tobacco smoke that the smokers had difficulty in seeing. A "smoke" is a better fireman than man, for thousands of dollars go up the chimney a year in carbon monoxide waste, yet a "smoke" is practically a complete combustion process.

7. Bleaching powder is made from lime and chlorine gas. If the lime contains much iron or manganese compounds, there will likely be a chemical reaction in the can which releases oxygen gas and causes tops to be blown from the bleaching powder cans held in storage. In making the bleaching powder, chemical analysis informs the manufacturers which lime to use.

8. Artificial frost on glass or mirrors is made by making a strong hot solution of Epsom salts, or magnesium sulphate as it is called, and sopping this upon the glass. Crystallization will soon set in and produce a beautiful frost like appearance.

9. Chemists have a funny way of remembering long chemical names. They make a mental picture of it and say it. For instance three six-sided rings shown here is the picture of anthracene, which is a very simple compound to remember in itself. Two rings of six sides each is napthalene—known to you as moth balls.

10. No, ocean cables are not pure lead. It has been found that 99 per cent. lead and 1 per cent. antimony—latter combined with sulphides is the stuff that makes red rubber, produces an alloy which has better properties than pure lead. It is the little things such as 1 per cent. that make a difference in this world.

11. A recently invented "gasified" ice cream (Heathized) has carbon dioxide gas contained in it. This is the same gas in our soda water, our exhaled breath, and from our furnaces. It develops the flavor, makes the cream more stable as to melting, and actually exerts a sterilization of the other ingredients.

12. Silicon which we use in radio detectors is not a mineral, for it is not found in nature as it is. It is produced from pure sand, which is silicon dioxide or silica, from which the "dioxide" or oxygen has been abstracted in the electric furnace, leaving the element silicon behind.

A record for long distance communication by radio between a ship at sea and a shore station was made recently by the Federal Telegraph Company's beach station. The station exchanged messages with the Oceanic lines, *Ventura*, then 6,285 miles southwest of San Francisco.

WANTED!!! RADIO ARTICLES

WE want descriptions of new radio ideas which you have worked out in practice. Take photographs of the important parts and make pencil or pen and ink sketches of the hook-ups or mechanical details, et cetera. We are particularly desirous of obtaining new hook-ups and descriptions of single tube sets, reflex and other types which have proven satisfactory.—
Editor.

FREE *with this* BIG 3 FT. TELESCOPE

Yes—absolutely free! This substantial leatherette covered **Carrying Case** complete with strap, free with "Wonder" Telescope. Case measures 12 inches long, 2½ inches in diameter.

Everybody wants a telescope. Here's one that will show you people and objects a long way off just like they were close. See things miles away on land and sea. See moon and stars as never before.

Over 3 ft. long in 5 Sections

This big telescope opens out over 3 ft. long and measures 12 inches when closed. Just think of a big telescope over a yard long! It is brass bound and has powerful chromatic lenses. Have barrels of fun entertaining your friends day and night. Send now—be first in your neighborhood to have the big "Wonder" achromatic Telescope and FREE carrying case.

The "Wonder" Telescope gives new pleasures to home, farm, camp, travel, sport. Needed by Farmers to count stock, inspect fences and see persons in distant fields. Used by Auto Tourists, Boy Scouts, Sailors, etc. Biggest telescope value ever offered. Get the genuine "Wonder" Telescope from Ferry & Co. Read our special offer.

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ALL Delighted!

"I am delighted with the "Wonder" telescope. Today I have been watching submarines 3 miles off the coast." — Philip Brush, Beverly, Mass. "The telescope I received last month is very fine. I live on a bluff and can see across the Mississippi 3 miles and see people fishing."—M. L. Thorn, St. Louis, Mo. "I am nearly 80 years old and if I could not get another would not take $10.00 for it."—A. R. Walker, Dayton, Ohio. "I have had my "Wonder" Telescope 6 months. I can tell time on the church clock 5 miles away."—Edw. Foster, Baltimore, Md. "Could tell color of aeroplane 4 miles away."—Mrs. L. M. Yarbrough, Stringer, Miss. "I am very much pleased with telescope. I saw a Light House 18 miles away."—Clyde Scribner, Taunton, Mass. "Far above my expectations. Can see men working 7 miles away."—S. M. Gearhart, Bolan, Iowa. "I could see a wind-mill on a farm across a lake more than 4 miles away. I am much pleased."—Raymond Cosanova, Hudson, Wis. The "Wonder" Telescope makes a "hit" everywhere. Send for yours today on our big FREE offer.

Send No Money

Because of a fortunate purchase from a large European manufacturer we are offering you this big bargain. Send only your name and address and we will send the "Wonder" 3 ft. achromatic Telescope and FREE Carrying Case by Parcel Post. On arrival pay Postman only $1.85 plus a few pennies postage. **Satisfaction guaranteed** or money refunded. Order **today** while the supply lasts.

FERRY & CO., 3224 N. Halsted St., Dept. 1258, Chicago, Ill

Mail this coupon now for 3 ft. Telescope and FREE Carrying Case

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Send me 3 ft. "Wonder" Telescope and Free Carrying Case. On arrival I will deposit $1.85, plus postage, with postman. If I am not satisfied you will refund my money.

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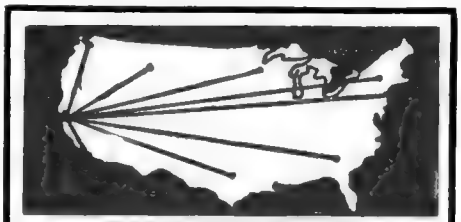
City..... State.....



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BIG FREE BOOKLET tells the story. California users of CROSS COUNTRY CIRCUIT hear Atlantic Coast, Canada, Cuba, Mexico and Hawaii. Atlantic Coast users hear England to California. Our new plan makes this set easiest and cheapest to build. One hour puts in operation. One tuning control. No soldering. Any novice can do it. BIG BOOKLET FREE or complete instructions for 25c stamps or coin.
VESCO RADIO CO. Box 81-117 Oakland, Calif.

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Learn by the thorough approved scientific methods which our nineteen years of specializing enable us to give you. **A.C. and D.C. Armature Winding, Wiring and Testing. Practical Electricity, Drafting, Electrotechnics, Commercial Electrical Engineering, Electrical Engineering with B. S. Degree. "Earn While You Learn."** Radio Broadcasting W. S. O. E. Every Day.

Term opening Nov. 10th and Jan. 5th. Write for 72-Page Illustrated Catalog. **It's Free.** Mention Age, Education and Course interested in. Also see our ad on page 708.

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CAN BE CURED. If you suffer from pimples, acne, blackheads, brown spots or eruptions I want to send you my simple home treatment under plain wrapper. It gave me a soft, velvety, smooth and radiant complexion, and cured thousands of men and women, after everything else failed. Simply send name for generous 10 day free trial offer of my secret home treatment.
W. H. WARREN, 563 Gateway Sta., Kansas City, Mo.

RADIO WONDER—3000 miles regular range of the famous one tube (Drycell) Hummer Set. Inexpensive, simple, and easy to build. All users of this circuit report excellent results. Complete Hummer diagram, list of parts, full size panel layout, instructions etc. postpaid only 50c. Order now from me, the originator of the Hummer Circuit, and be another satisfied Hummer Fan.

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MODEL SLIDE VALVE MARINE ENGINE—
½" bore, $12.75, or ⅝" bore, $15.75 You will probably wish to make your own model boat hull, but what about your power unit? We are builders of working model engines and boilers of many types. We can supply you with a power unit that will meet the requirements of your particular model boat. Boiler, Ship and Naval fittings. Special work. Large illustrated catalogue, 20c.
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Send for booklet showing photos of Men with and without the (PERFECT LEG FORMS) for BOW LEGS and KNOCK-KNEES. Also BRACES, for children for PERMANENT CURE.
Perfect Sales Co., 146 N. Mayfield Ave., Dept. 57 Chicago, Ill.

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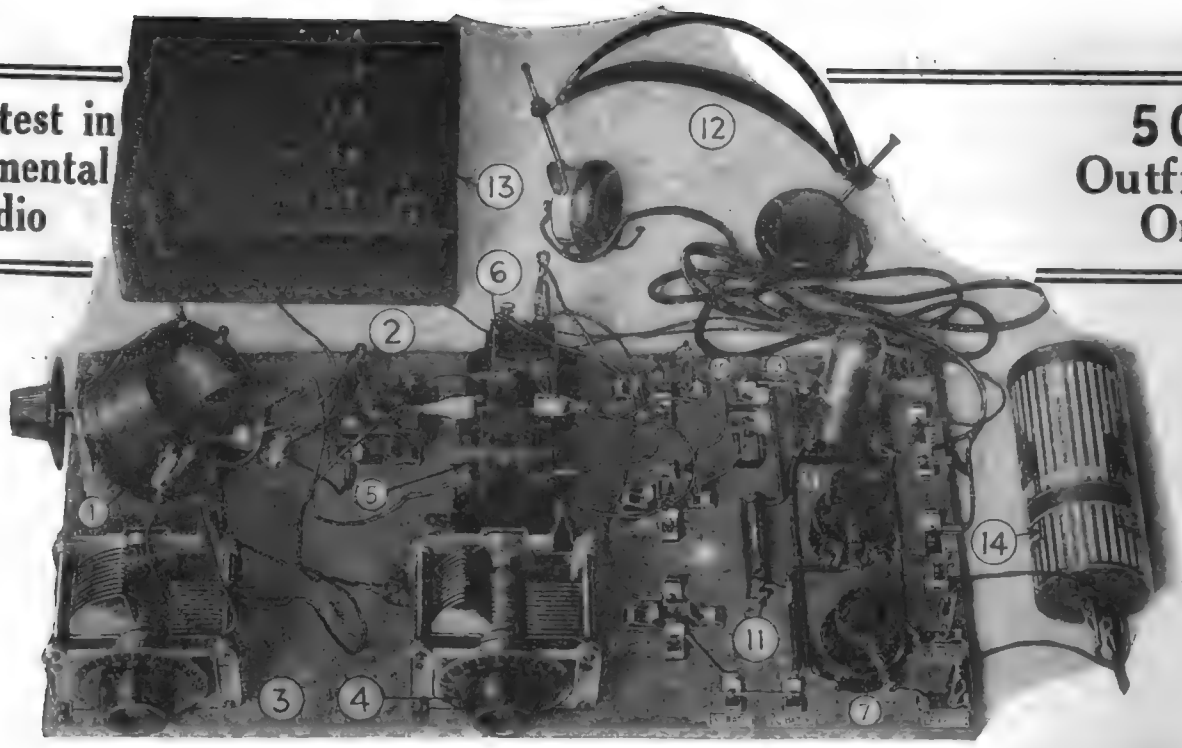
The Latest in Experimental Radio



500 Outfits in One

MEET THE HOOK-UP BOARD

Mr. H. Gernsback's newest idea for the radio experimenter. With this Hook-up board you can hook up any and every reflex circuit in existence, as well as many other circuits.

By means of the new CLIP LEADS and TIP LEADS, instantaneous connections can be made or broken. You will want to know all about it,—every little detail. The days of tedious connections by old fashioned wires and binding posts are past,—thanks to the Hook-up board.

Featured in the November issue of THE EXPERIMENTER.

The "EXPERIMENTER" Comes Back

WHEN the ELECTRICAL EXPERIMENTER started in 1913, wireless, as Radio was then called, was young. The ELECTRICAL EXPERIMENTER at that time was the foremost exponent of wireless, but wireless was in its infancy and did not have a large following. Electrical subjects, plus wireless, were not sufficient to build up a large circulation, hence the ELECTRICAL EXPERIMENTER in 1920 changed its name to PRACTICAL ELECTRICS.

In the meanwhile, about 1919, radio had become a big thing, and a separate magazine, now known as RADIO NEWS, was found necessary, as it was impossible to do all of the radio subjects justice in a magazine covering every phase of scientic progress.

When PRACTICAL ELECTRICS was started three years ago, I had hoped that there would be enough readers interested in electrical subjects only, but this hope was not fulfilled. PRACTICAL ELECTRICS never published more than 60,000 copies.

During the past six years, I have been deluged with letters from admirers of the old ELECTRICAL EXPERIMENTER. Many of my former readers deplored the fact that the ELECTRICAL EXPERIMENTER was no more. I have given the matter very long and serious thought of late and decided to bring back the old ELECTRICAL EXPERIMENTER, not only as it was at its best, *but infinitely better*. That is why, beginning with the November issue, PRACTICAL ELECTRICS becomes THE EXPERIMENTER.

Those of you readers who remember the ELECTRICAL EXPERIMENTER, I know, will be delighted with the new magazine. There will be only three subjects, ELECTRICITY—RADIO—CHEMISTRY. 90% of the magazine will be devoted to experiments. The radio section, by the way, will be a brand new kind of radio, entitled *"Experimental Radio."*

There will be nothing but experiments written by the foremost writers. Here are a few of the radio experimental articles that appear in the November issue:

Single Tube Reflex Experiments.....Clyde J. Fitch
Converting the Single Circuit Tuner.....A. P. Peck
The Simpledyne Circuit.....Aurelio L. Fernandez
Radio Frequency Circuits.....W. L. Pearce
Single Control Receivers.....Marius Logan
Loop Aerial .....Elvin Tilton
Reaching Out with a Crystal Detector,
John Underhill House

There will also be a monthly editorial written by myself giving pointers on experimental work. Having been experimenting for some 20 years, it is my humble opinion that I am qualified to speak with authority on the subject.

The new EXPERIMENTER will be a huge improvement over the old PRACTICAL ELECTRICS: Better and more illustrations, more text, more pages. It has the sort of reading matter that every wide-awake experimenter craves for.

It also has a new eight-page roto-gravure section. In short, the magazine is *new* and better from start to finish. Look over your first copy, and I am sure it will convince you that the old EXPERIMENTER really has come back.

H. GERNSBACK, *Editor.*

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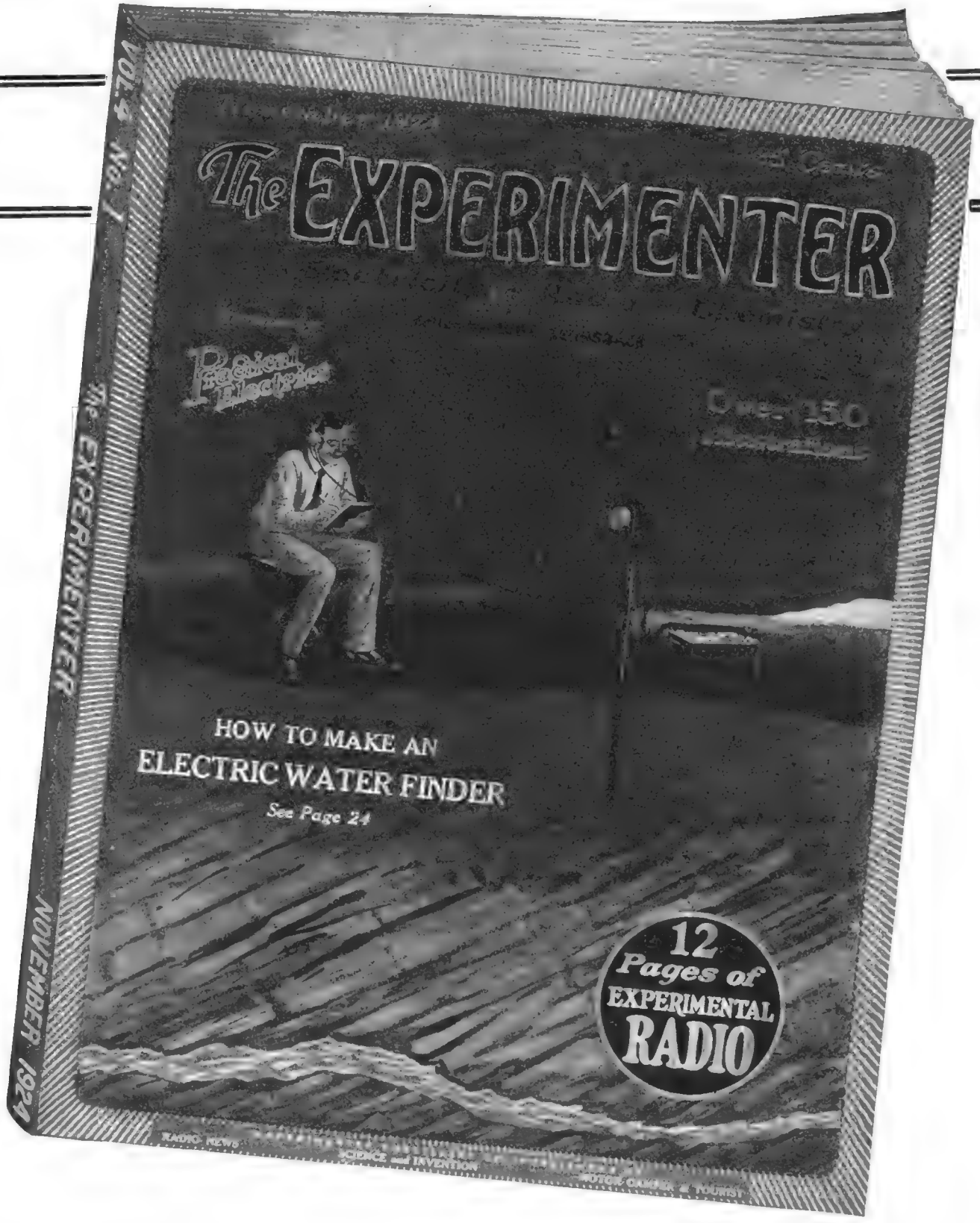

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GERMOTT PUBLISHING CO., Inc. 53 Park Place, New York City

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UNIVERSITY OF CHICAGO

RADIO'S GREATEST MAGAZINE

1st

In Every Department

1st—In Size

The reader of RADIO NEWS gets more material, more editorial matter and more advertising presentations than any other radio magazine. It carries more columns of reading matter than any competitive radio publication.

1st—In Circulation

The distribution of the November Issue of RADIO NEWS was 400,000 copies. A gigantic number of books. This tremendous output of copies of RADIO NEWS is far more than double the output of any other Radio Publication. RADIO NEWS is far and away the first in circulation.

1st—In Advertising

RADIO NEWS carries more than twice as much advertising as any other Radio Magazine. The total number of lines of advertising carried in the November issue is 63,095. There is not a consistent Radio Advertiser of prominence that does not use RADIO NEWS. When you are looking for a place to buy Radio equipment read the advertising pages of RADIO NEWS.

1st—Editorially

There never was a question raised by anyone familiar with radio publications to dispute the fact that RADIO NEWS carries more editorial matter than any other Radio Magazine. There is no vital invention or development in radio that is not sooner or later in the pages of RADIO NEWS, and RADIO NEWS in the majority of cases is first in presenting to the public the modern developments in Radio.

RADIO NEWS was first in placing before the radio public the revolutionary development of the SOLODYNE, the tube that needs no "B" batteries. RADIO NEWS was first in the introduction of the CRYSTODYNE, the oscillating crystal detector. Every RADIO NEWS reader can be certain that there will be no vital development in Radio that will not be in the pages of RADIO NEWS.

RADIO NEWS

RADIO'S GREATEST MAGAZINE

APPROVED
RADIO NEWS
LABORATORY

RADIO NEWS was first in the introduction of the laboratory testing of advertised products for radio magazines. The product that bears the above stamp of approval has been thoroughly tested and has withstood the exacting requirements of one of Radio's foremost engineers.

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Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section twelve cents a word for each insertion. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Ten per cent. discount for 6 issues, 20 per cent. discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the January issue must reach us not later than November 10th.

The Circulation of Science and Invention is over 150,000 and climbing every month

EXPERIMENTER PUBLISHING CO., INC., 53 Park Place, New York City, N. Y.

Agents Wanted

Agents—Best seller; Jem Rubber Repair for tires and tubes; supersedes vulcanization at a saving of over 800 per cent; put it on cold. It vulcanizes itself in two minutes and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., Dept. 601, Philadelphia, Pa.

Big money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co. Dept. 71, East Orange, N. J.

We start you without a dollar. Soaps, Extracts, Perfumes, Toilet Goods. Experience unnecessary. Carnation Co., Dept. 232, St. Louis.

Make $25 to $50 week representing Clows' Famous Philadelphia Hosiery, direct from mill—for men, women, children. Every pair guaranteed. Prices that win. Free book "How to Start" tells the story. George Clows Company, Desk 27, Philadelphia, Pa.

Only one sale a day means $200 per month. Five sales, $1,000 per month. Marvelous new adding machine. Retails $15. Work equals $350 machine. Adds, subtracts, multiplies, divides automatically. Speedy, accurate, durable, handsome. Five-year guarantee. Offices, stores, factories, garages buy one to dozen. A fortune for live agents. Write quick for protected territory and free trial offer. Lightning Calculator Co., Dept. W., Grand Rapids, Mich.

Earn big money fast applying gold initials to autos. Every owner buys—$1.35 profit on $1.50 sale—particulars and samples free. Write quick. Lithogram Co., Dept. 19, East Orange, N. J.

We want Salesmen and Agents, either whole or side line, to sell our low priced radio books to the trade. Excellent proposition for live wires. The E. I. Company, Publishers, 233 Fulton Street, New York City.

Earn $10 daily silvering mirrors, plating and refinishing metalware, chandeliers, bedsteads, headlights. Outfits furnished. N. Decie Laboratories, 1133 Broadway, New York.

$60—$200 a week. Genuine Gold Letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 441 B., North Clark, Chicago.

Big money and fast sales. Every owner buys gold initials for his auto. You charge $1.50, make $1.44. 10 orders daily easy. Samples and information free. World Monogram Co., Dept. 32, Newark, N. J.

Rummage sales make $50.00 daily. Offer wonderful values. We start you. "Wholesale Distributors." Dept. 32, 609 Division Street, Chicago.

Men's Shirts. Easy to sell. Big demand everywhere. Make $15.00 daily. Undersell stores. Complete lines. Exclusive patterns. Free samples. Chicago Shirt Manufacturers. 229 W. Van Buren, Factory 212, Chicago.

Big Money selling New Household cleaner. Washes and dries windows. Sweeps, scrubs, mops. Complete outfit less than brooms. Over 100 per cent profit. Harper Brush Works, 152—3rd St., Fairfield, Iowa.

Agents—Write for Free Samples. Sell Madison "Better-Made" Shirts for large Manufacturer direct to wearer. No capital or experience required. Many earn $100 weekly and bonus. Madison Mills, 564 Broadway, New York.

Agents—Make $25.00-$100.00 weekly selling Comet Sprayers and Autowashers to farmers and Autoists. All brass. Throws continuous stream. Established 30 years. Particulars free. Rusler Co., Johnstown, Ohio, Box C47.

Succeed With Your Own Products—Formulas, Processes. Different, Dependable, Profitable. Catalog Free. D. Thazly Co., Washington, D. C.

Agents—Pick up $5.40 for few minutes work. Then, if you like, become "regular" representative making $10-$15 daily. Write quick for particulars. Pitkin Company, 694 Pitkin Building, Newark, New York.

$25.00 a day easy! Best line of brushes on the market. 90 varieties, including famous Auto Fountain Washer. Excellent territory available. Write immediately. Philadelphia Brush Co., Dept. 26, Vineland, N. J.

Agents Wanted Full or Part Time to Sell on liberal commission new Thermostatic Automatic Carburetor control Attachment for Ford cars. Increases mileage 100%. No holes to drill. Attached in 2 minutes. Does automatically exactly what Ford Manual instructs driver do by hand. Cadillac now using Thermostatic Carburetor Control under Blancke license. Write at once. A. C. Blancke & Co., Dept. 451 E, 602 W. Lake St., Chicago.

Twelve Dollars starts you in profitable spare or full time manufacturing line, sell by mail, get all the profits. No canvassing. We furnish everything. Details free. Spicer Chemical Co., Box 1628, Joplin, Mo.

Agents! New 1924 Household Specialty, wonderful seller, 200 percent profit, sample 25c, particulars free! Wright Specialty Sales Co., 324 Laughlin Bldg., Los Angeles, Calif.

Agents Wanted (Continued)

District Managers Wanted—Appoint Local Agents for us in your locality. No canvassing or delivering. $100.00 weekly easily made. Commissions advanced. Bob Russell, Z 2307 Archer, Chicago, Ill.

Agents—$15 a day—Easy, quick sales—Free Auto—Big weekly Bonus—$1.50 premium Free to every customer. Simply show our Beautiful, 7 piece, Solid Aluminum Handle Cutlery Set. Appeals instantly. We deliver and collect. Pay daily. New Era Mfg. Co., 803 Madison St., Dept. 88A, Chicago.

Agents—Answer this advertisement—our proposition is too good to pass up. $15 a day; automobile free; exclusive territory. Write today for details of this sound, high-grade, permanent proposition. American Products Co., 2008 American Bldg., Cincinnati, O.

Men's Shirts—$25 to $75 weekly—Factory to Wearer. Big Sellers. Undersell stores. Free samples. Pay advanced. Illinois Shirt Mfgrs., 510 So. Wells, Factory, 206, Chicago.

Write and learn how to start profitable business without capital or experience. Silvering mirrors, refinishing auto headlights, tableware plating. Outfit furnished. International Laboratories, Dept. 25, 309 Fifth Ave., New York.

Agents—Be Independent, make big profit with our soap, toilet articles and household necessities. Get free sample case offer. Ho-Ro-Co., 2719 Dodier St., St. Louis, Mo.

27,000 phonograph needles eliminated by one Everplay. Nothing like it. Preserves records. Abolishes scratching. Day's supply in pocket. $20 daily. Everplay, Desk H-11, McClurg Bldg., Chicago.

$10 daily silvering mirrors, plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write Gunmetal Co., Ave. D, Decatur, Ill.

Young Men who want to make their spare time pay from $20 to $50 a week are offered an opportunity to sell an article which every man buys on sight, made by Ingersoll the dollar watch man; retails for $1; you don't need to be a salesman; merely to show is to sell; big profits, quick sales and constant repeat business; write today. Robt. H. Ingersoll, 476 Broadway, Dept. 212, New York.

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Opportunity to start Manufacturing Metal Toys and Novelties. No experience necessary. Enormous demand exceeds supply. We furnish, at cost, casting forms for production and buy entire output, also place yearly contract orders. Casting forms made to order. Catalog, advice and information free. Metal Cast Products Co., 1696 Boston Road, New York.

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Books

Perpetual Motion, by Percy Verance. A history of the efforts to discover same from earliest days to the present, together with a scientific discussion regarding the possibility of its ultimate achievement. Profusely illustrated. 357 pages. Price postpaid, $2.00. The Enlightenment Specialty Co., 305 Fourth St., Edwardsville, Ill.

"Nature's Finer Forces," Vibrations; Lights; Colortones; Electromagnetons; Odicaura; Radio; Coldlights; Inventions; Wonderful Opportunities; Fifty Lessons; Marvelous Cures; Illustrated 270 pages. $2.00. DeLuxe $3.00. Stevens Research Laboratories, 242 Powell, San Francisco.

Hypnotism. Astounds, controls. Wants gratified. Disease eliminated. 25 Easy Lessons $1.00 "Mindreading" (Any distance) wonderful. Success guaranteed. 60c "How to Win in Business, Love and Society" 400 pages $3.00. Catalog free. Science Institute, SE 1014 Belmont, Chicago.

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Magic Goods, cards, books, novelties, tricks. Catalog free. Clifford Fenner, 2401 Jefferson, Louisville, Ky.

2 New Books on Sex, Love, Marriage, etc. Plain facts for adults, 224 pages, both 25c. F. Smetana Company, Owosso, Michigan.

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If you have adaptability to selling specialties, exclusive territory is available on the Hush-A-Phone. This device is generally recognized by the largest concerns in the country, as superior to a phone booth for voice privacy, office quiet, and telephoning in noisy places. Over a thousand banks have adopted it. It is without competition. Energetic men can make a life occupation of selling the Hush-A-Phone in their section. Office appliance, and telephone men particularly adapted. Write for proposition. Hush-A-Phone Corp., Room 1311, 19 Madison Avenue, New York City.

Dollars yearly in your backyard. No mushroom dope. Particulars free. Metz, 313 East 89th, New York.

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Airplane Engineering, under the Western Airplane Corporation method of practical home training, offers you a chance to be Successful and become a Leader in this newest industry. Written for the Airplane Industry by Airplane men, this Up-to-date Course is offered to you for the First Time after training hundreds of successful Mechanics and Engineers. Write for catalog. Western Airplane Corporation, Dept. S, Monadnock Block, Chicago.

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Make money with your camera. Lancaster-P, Box 436, Los Angeles, California.

Start a paying business at home or small office anywhere. Soliciting unnecessary. $50.00 weekly easy. Begin in spare time. Free Folder, Downs Co., 2327 Myrtle, St. Paul, Minn.

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Chemistry

Learn Chemistry at Home. Dr. T. O'Conor Sloane noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 719 of this issue. Chemical Institute of New York, 66 W. Broadway, New York City.

Correspondence Courses

Used correspondence courses of all schools sold, rented and exchanged. List free. (Courses bought.) Lee Mountain, East Chattanooga, Tenn.

District Representatives

Money-making opportunity selling Radiolite system of charging batteries. Sells to battery stations, garages, auto-owners. White for information and free demonstration offer. Radiolite Co., Dept. N, St. Paul, Minn.

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Join our home study club and save over 50% on new or used correspondence courses. Particulars free. Courses bought. Students' Exchange, Dept. A, 47 West 42d St., New York.

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24 words—355 Rural Weeklies $14.20. Ad-Meyer, 4112 SI, Hartford, St. Louis, Mo.

For Inventors

We Develop Your Ideas into commercial shape for presentation to purchasers making working models, drawings, experiments or tests. Courtesy, efficiency, secrecy and ample equipment; 30 years' experience. Ducorron-Rich Engineering Co., 504 Pacific Mutual Bldg., Los Angeles, Cal.

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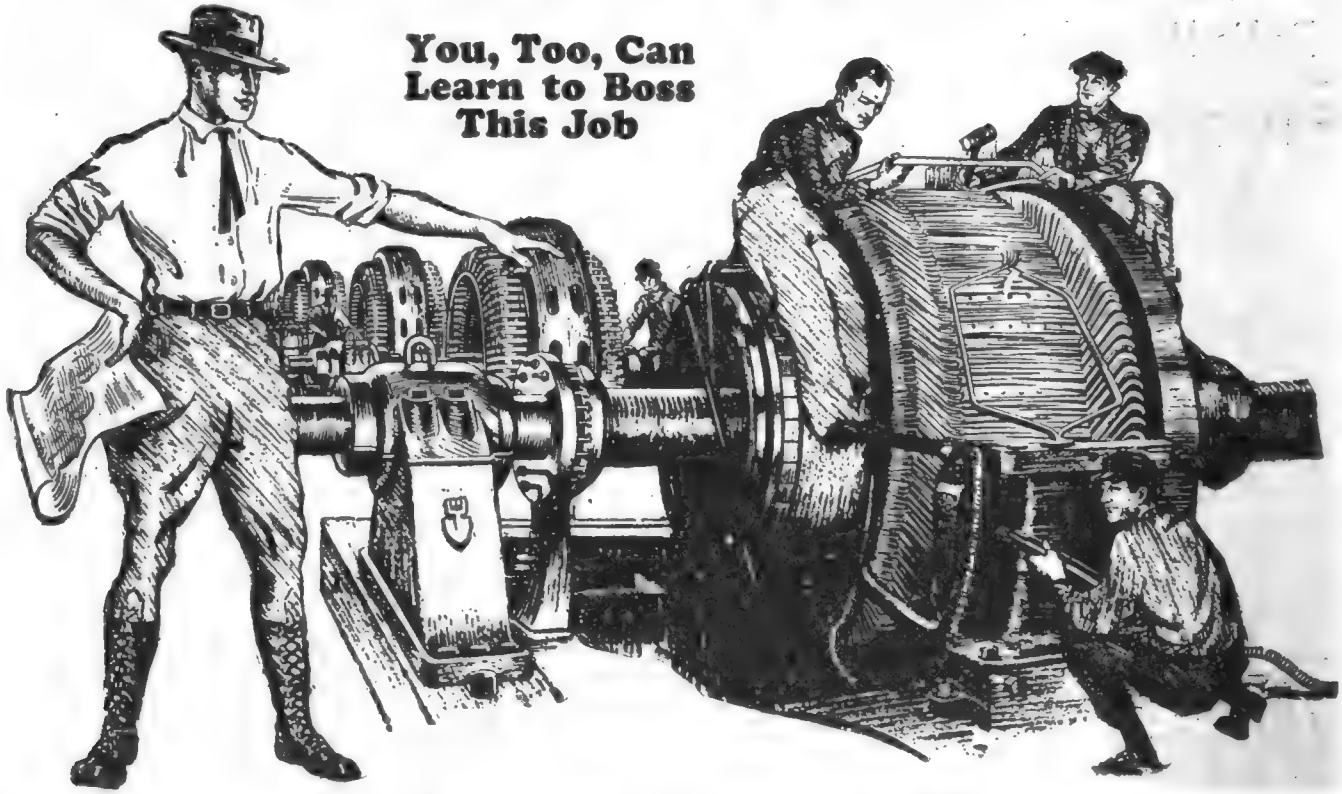
Be a Certificated Electrical Expert



EARN $3500 to $10000 a Year

Trained "Electrical Experts" are in great demand at the highest salaries, and the opportunities for advancement and a big success in this line are the greatest ever known.

"Electrical Experts" earn $70 to $200 a week.

Fit yourself for one of these big paying positions. In my twenty years of Electrical Engineering I have gathered some wonderful and interesting facts about this great industry — "Vital Facts." I will send them to you free.

Learn at Home to Earn $12.00 to $30.00 a Day

Today even the ordinary Electrician — the "screw driver" kind — is making money — big money. But it's the trained man — the man who knows the whys and wherefores of Electricity — the "Electrical Expert" — who is picked out to "boss" ordinary Electricians — to boss Big Jobs — the jobs that pay. You, too, can learn to fill one of these jobs — spare-time only is needed. Be an "Electrical Expert" — Earn $70 to $200 a week.

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You don't have to be a College Man; you don't have to be a High School graduate. If you can read and write English, my course will make you a big success. It is the most simple, thorough, and successful Electrical Course in existence, and offers every man, regardless of age, education, or previous experience, the chance to become, in a very short time, an "Electrical Expert," able to make from $70 to $200 a week.

Some Features of My Course That Make SUCCESS Certain

1. Practical Money-Making Instruction — no useless, high-sounding theory.
2. Free Electrical Outfit. — Finest outfit ever sent out for home experiment and practical use.
3. Free Employment Service. (Helps you get a good job.)
4. Free Consulting Service. (No chance to get stuck on anything, while studying or afterward.)
5. Free Engineering Magazine.
6. Free use of my Electrical Laboratory.
7. Extra Courses Free — Radio — Electrical Drafting.
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9. Reduced prices on all Electrical Supplies.
10. Cash Refund Guarantee Bond.

These features are all explained in my big Free Book.

I Give You a Real Training

As Chief Engineer of the Chicago Engineering Works, I know exactly the kind of training a man needs to get the best positions at the highest salaries. Hundreds of my students are now earning $3,500 to $10,000 a year. Many are successful ELECTRICAL CONTRACTORS.

Your Satisfaction Guaranteed

So sure am I that you can learn Electricity — so sure am I that after studying with me, you too, can get into the "big money" class in electrical work, that I will guarantee under bond to return every single penny paid me in tuition if, when you have finished my course, you are not satisfied it was the best investment you ever made.

FREE — Electrical Working Outfit — FREE

I give each student a Splendid Outfit of Electrical Tools, Materials and Measuring Instruments absolutely FREE. I also furnish them with all supplies, including examination paper, and many other things that other schools don't furnish. You do PRACTICAL work — AT HOME with this Outfit. You start right in after the first few lessons to WORK AT YOUR PROFESSION in a practical way.

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I want to send you the "Vital Facts" of the Electrical Industry including my Electrical Book, Proof Lessons, and a sample of my guarantee bond all FREE. These cost you nothing and you'll enjoy them. Make the start today for a bright future in Electricity. Send in the coupon — NOW.

L. L. COOKE, Chief Engineer

Chicago Engineering Works

Dept. 528 2150 Lawrence Ave., Chicago

Use this Free Outfit Coupon!

L. L. COOKE, Chief Engineer,
Chicago Engineering Works, Dept. 528
2150 Lawrence Ave., Chicago, Ill.

Dear Sir:—Send at once the "Vital Facts" containing Sample Lessons, your Big Book, and full particulars of your Free Outfit and Home Study Course — all fully prepaid, without obligation on my part.

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Please submit me for free examination, HAWKINS ELECTRICAL GUIDE (Price $1 a number). Ship at once prepaid, the 10 numbers. If satisfactory, I agree to send you $1 within seven days and to further mail you $1 each month until paid.

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Time and Postage Saver

IN every issue of SCIENCE and INVENTION you undoubtedly see numerous articles advertised about which you would like to have further information.

To sit down and write an individual letter to each of these respective concerns, regarding the article on which you desire information, would be quite a task.

As a special service to our readers, we will write the letters for you, thus saving your time and money.

Just write the names of the products about which you want information, and to avoid error the addresses of the manufacturers, on the coupon below and mail it to us.

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We will transmit to the various advertisers your request for information on their products.

This service will appear regularly every month on this same page in SCIENCE and INVENTION.

If there is any Manufacturer not advertising in this month's issue of SCIENCE and INVENTION from whom you would like to receive literature, write his name, address and the product in the special section of the coupon below.

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Experimenter Publishing Co., Inc., 53 Park Place, New York, N. Y.

Please advise the firms listed below that I would like to receive detailed information on their product as advertised in the ..... issue of SCIENCE and INVENTION.

NAME	ADDRESS (Street—City—State)	List here specific article on which you wish literature.	If Catalogue of complete line is wanted, check in this column.

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If you are a dealer check here. ☐

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Neglect of Home-Study Training Cost This Man $47,424!

How much are you paying to stay untrained?

The other day we received a letter which every man working for a living ought to read—whether he's making $20 a week or $200. Here it is:

"During the forty years that I have been working, my salary has averaged less than twenty-four dollars per week with the exception of the last two years while I have been acting as foreman of a department. I made good in this position on a small scale and saw, thru the failings of others, what would happen to me unless I found a way to train for larger responsibilities.

"I had read of correspondence courses and began searching for that which I thought would benefit me. I found it in the LaSalle Modern Foremanship course, and benefited by it, my salary being nearly doubled, and I was promoted from foreman to factory superintendent.

"This happened in a period of about ten months, and by devoting only about four or five hours per week to the studies.

"I am now enrolled as a member of the Industrial Management Efficiency course, and find the work very interesting and beneficial. It can be applied every day in the factory, and brings results.

"I regret that I put it off to so late a day in life to reap the benefits I am now enjoying, and can truthfully say to younger men that if they would only profit by the experience of others they can gain more knowledge thru one year's training by LaSalle methods than can be obtained in ten years' practical experience by hard work."

SHERMAN C. WOOD, Maryland.

We quote the above letter not because Mr. Wood is now making a staggering salary as a result of his training, but because it illustrates so clearly the principle behind LaSalle training.

Here is a man who all his life had accepted the thought that he was compelled to work for little or nothing.

For one thousand, nine hundred and seventy-six weeks the writer of this letter *paid at least $24 a week for the doubtful privilege of staying in the ranks of untrained men.*

Can anyone doubt that training would have doubled his salary just as easily when he was thirty-eight years younger—when he could attack his work with the abundant energy of a younger man?

Yet his neglect of this one main avenue of business progress cost him—leaving simple and compound interest out of the reckoning—the appalling sum of $47,424—a fortune in itself.

If You Could Use $47,424, Pause Before You Turn This Page

Perhaps you are now making quite as much as Wood—perhaps more. Perhaps, on that account, you may think that Wood's experience does not apply to YOU.

But if training in Higher Accountancy—or Modern Salesmanship—or Business Management—or Law—or Business Correspondence—or any of a dozen other branches of business could change your forty-eight dollars into *$96 a week*—and if you now NEGLECT to advance yourself thru the training you need—will you not find it difficult, thirty-eight years from now, to explain to those who are dear to you why you threw away—not $47,424, but *fully $95,000?*

We're not going to moralize. We're not even going to cite you any of the thousands of letters from men who have not merely doubled but tripled and quadrupled their incomes thru home-study training under the LaSalle Problem Method. We *have* the letters. We will *show* them to you, if you like. But understand, please, that they would not *alter* the facts—they would merely *emphasize* them.

Below this text there is a coupon. It will bring you not only full details of the training that appeals to you, but also a copy of that most inspiring book, "Ten Years' Promotion in One."

If you are sincere in your desire for advancement, you will not turn this page until you have clipped the coupon, filled it in, and by placing it in the nearest mail box placed *yourself* on the road to real success.

LaSalle Extension University

The World's Largest Business Training Institution

—INQUIRY COUPON—

LaSALLE EXTENSION UNIVERSITY Dept. 12384-R **Chicago, Illinois**

Please send me catalog and full information regarding the course and service I have marked with an X below. Also a copy of "Ten Years' Promotion in One," all without obligation to me.

- ☐ **Business Management:** Training for Official, Managerial, Sales and Departmental Executive positions.
- ☐ **Modern Salesmanship:** Training for position as Sales Executive, Salesman, Sales Coach or Trainer, Sales Promotion Manager, Manufacturer's Agent, Solicitor, and all positions in retail, wholesale, or specialty selling.
- ☐ **Higher Accountancy:** Training for position as Auditor, Comptroller, Certified Public Accountant, Cost Accountant, etc.
- ☐ **Law: Training for Bar; LL. B. Degree.**
- ☐ **Commercial Law:** Reading, Reference and Consultation Service for Business Men.
- ☐ **Traffic Management—Foreign and Domestic:** Training for position as Railroad or Industrial Traffic Manager, Rate Expert, Freight Solicitor, etc.
- ☐ **Railway Station Management:** Training for position of Station Accountant, Cashier and Agent, Division Agent, etc.
- ☐ **Banking and Finance:** Training for executive positions in Banks and Financial Institutions.
- ☐ **Modern Foremanship and Production Methods:** Training for positions in Shop Management, such as that of Superintendent, General Foreman, Foreman, Sub-Foreman, etc.
- ☐ **Industrial Management Efficiency:** Training for positions in Works Management, Production Control, Industrial Engineering, etc.
- ☐ **Personnel and Employment Management:** Training in the position of Personnel Manager, Industrial Relations Manager, Employment Manager, and positions relating to Employee Service.
- ☐ **Modern Business Correspondence and Practice:** Training for position as Sales or Collection Correspondent, Sales Promotion Manager, Mail Sales Manager, Secretary, etc.
- ☐ **Expert Bookkeeping:** Training for position as Head Bookkeeper.

- ☐ **Business English:** Training for Business Correspondents and Copy Writers.
- ☐ **Commercial Spanish:** Training for position as Foreign Correspondent with Spanish-speaking countries.
- ☐ **Effective Speaking:** Training in the art of forceful, effective speech, for Ministers, Salesmen, Fraternal Leaders, Politicians, Clubmen, etc.
- ☐ **C. P. A. Coaching for Advanced Accountants.**

Name..... Present Position.....

Address.....

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Book No. 1

Many men fail in building their Radio sets because of some trivial error that could easily have been corrected before it was too late. The E. I. Company has compiled a book that will help you avoid all the common pitfalls while building your Radio sets.

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The man who wants to build only those PRACTICAL Radio Sets that are guaranteed to give good results when properly constructed will need this book. Gives the principal successful hookups of practical Radio Construction.

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Book No. 3

Question No. 1—What is Radio? This is the nature of the questions that this book answers. Then it answers questions on all the principal parts of a Radio Receiver. It is a handy book to keep in your Radio File.

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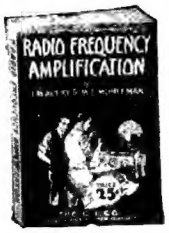

Book No. 4

Distance lends enchantment — and its the Radio Frequency Amplification that brings in the distance on your Radio Receiver. If you contemplate adding any Radio Frequency to your set you'll want this book at your side.

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Book No. 6

Don't struggle in the dark, looking for stations—here is an inexpensive book that gives you detailed instructions on just how to handle your Radio set. You will be surprised at the increased results that can be obtained through proper tuning.

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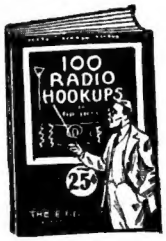

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The E. I. Co. books, as shown here, are expressly written, by radio experts, for the man who wants to understand his radio receiving set. The important points are all covered and fully explained in simple, everyday language.

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Everyone who constructs a radio set should know the simple fundamentals of the various parts of his set. The E. I. Company has set these forth in a compact little book that is valuable at all times.

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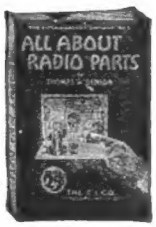

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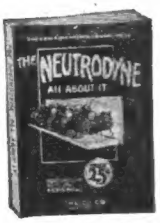

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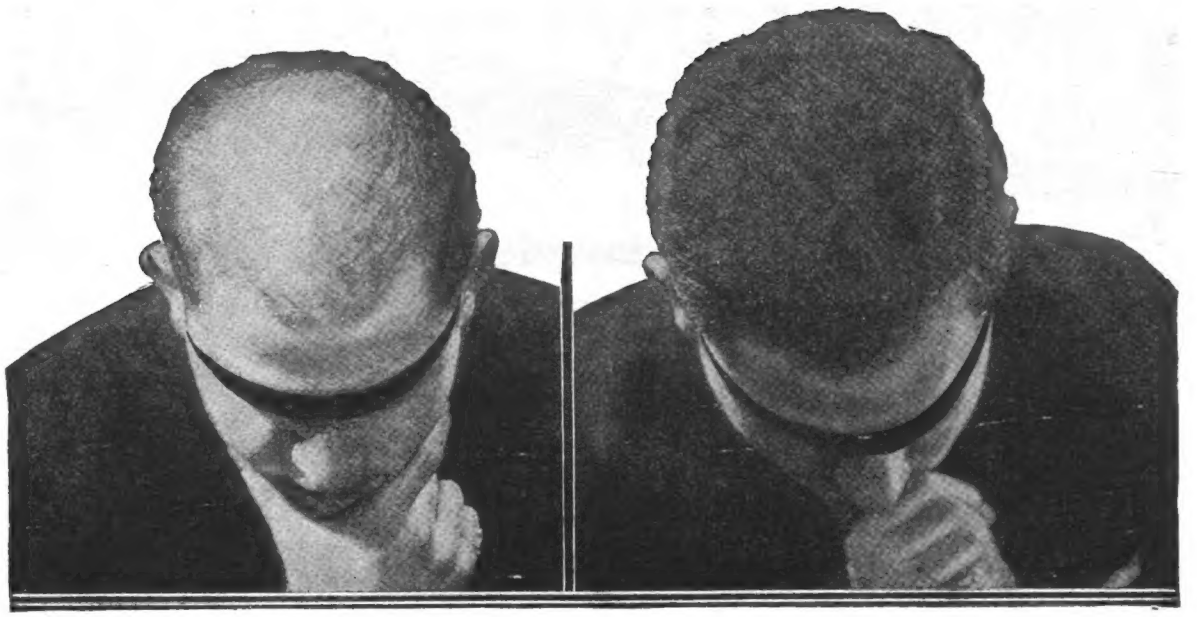

Here's Positive Proof That I Can Grow New Hair

These are true, unretouched photographs showing Mr. Murray Sandow's hair before —and 60 days after using my remarkable new treatment for baldness and falling hair. This is not a rare instance. Many others report equally astonishing results. To try my new discovery you need not risk a cent. For I positively *guarantee* results or charge you nothing. Mail coupon below for booklet describing my treatment and 30 Day Trial offer in detail.

By ALOIS MERKE

Founder of Merke Institute, Fifth Ave., N. Y.

FOR many months you have seen announcements concerning my new treatment for baldness and falling hair. If you are bald and have tried other treatments without results then naturally you are skeptical. All right, I don't blame you.

But what better PROOF is there that I can *actually grow new hair* than these two photographs reproduced above. They illustrate a result that hundreds of others have written us they too have secured through use of my marvelous discovery. In this particular case, Mr. Murray Sandow, of New York City, started my treatment January 23, 1924 —and sixty days later—as you can see—he had an almost entirely new growth of hair.

Entirely New Method

My invention involves the application of new principles in stimulating hair growth. It proves that in many cases of baldness—the hair roots are not *dead*—but merely *dormant*. The reason tonics and other treatments fail to grow new hair is because they do not *reach* these *dormant hair roots*, but instead simply treat the *surface* of the scalp.

To make a tree grow you could not rub "growing fluid" on the bark. Instead you would get right to the roots. And so it is with the hair.

No Excuse for Most Baldness

At the Merke Institute on Fifth Avenue, New York, I've treated scores of prominent stage and social celebrities—some paying as high as $500 for the results my methods produced. Yet now by means of The Merke Thermocap Treatment, adapting the same principles to home use—thousands of men and women everywhere are securing the desired results—right in any home where there is electricity —*and for just a few cents a day!*

I don't say my treatment will grow hair in every case. There are some cases that nothing in the world can help. But since so many others have regained hair this way, isn't it worth a trial—especially since you do not risk a penny? For at the end of a month if you are not more than delighted with the growth of hair produced, you won't be out a cent. That's my absolute *Guarantee.* AND YOU ARE THE SOLE JUDGE.

Coupon Brings FREE Book

No matter how thin your hair may be—no matter how many methods you have tried without results, send at once for the 32-page book telling about this wonderful SCIENTIFIC TREATMENT. It gives scores of reports from others which indicate what this treatment will mean to you. Merely fill in and mail the coupon below and I will gladly send you the vitally interesting 32-page booklet giving full details about the famous Merke Thermocap Treatment. Clip and mail the coupon today. **Allied Merke Institutes, Inc., Dept. 4612, 512 Fifth Avenue, New York City.**

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Please send me, without cost or obligation on my part, the free copy of the new booklet describing in detail the Merke Thermocap treatment.

Name .....
(State whether Mr., Mrs., or Miss)

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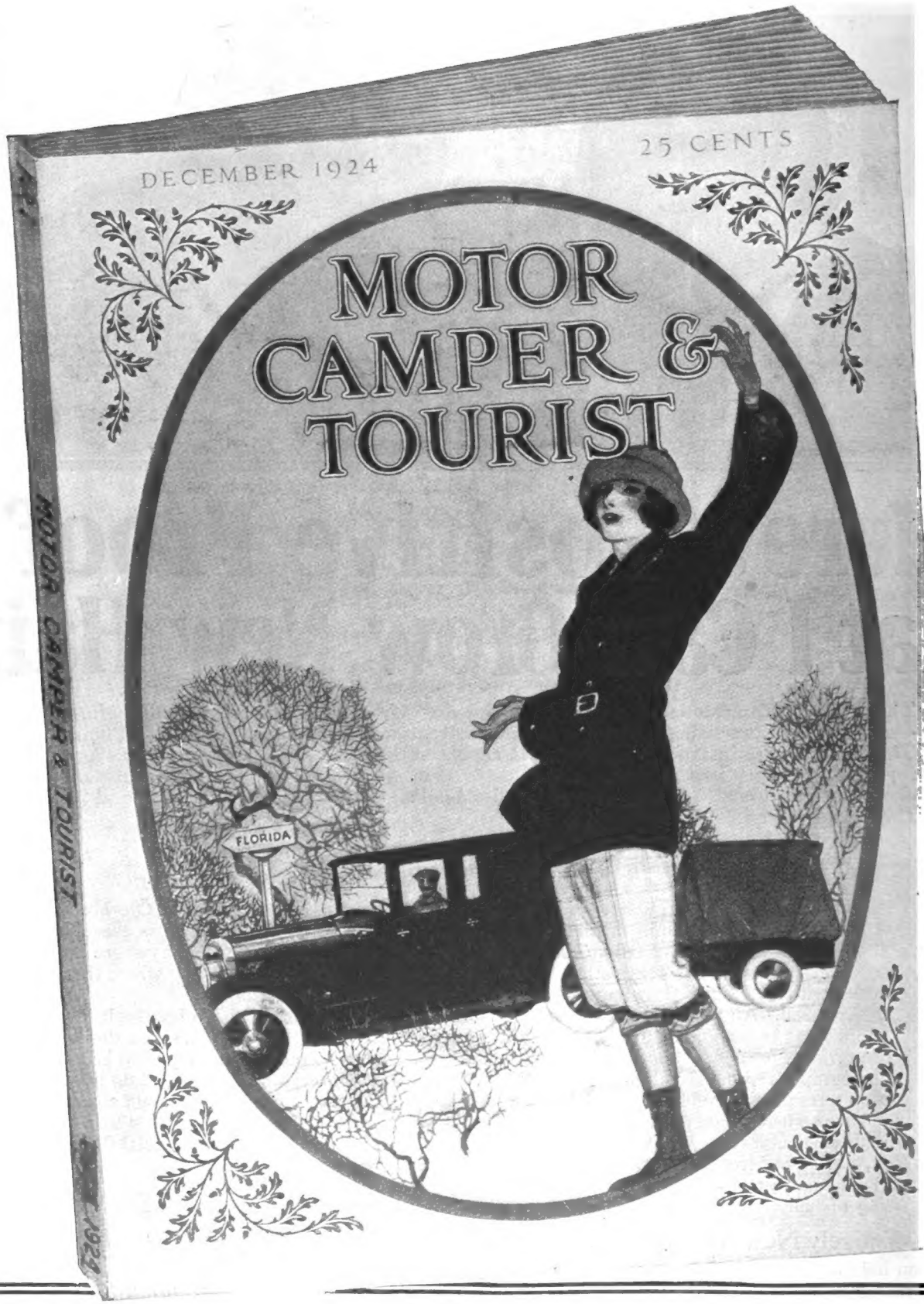

2503 Miles to the Southland for $40

At an actual cost of slightly under $40 a school principal in Montana undertook a 2,503 mile tour in his car to San Diego, California. This included the price of gas and oil.

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